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JULY 1985

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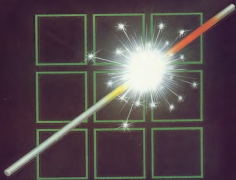
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Our COMMENT

PICTURE IT. ANOTHER SLEEZY AFTERNOON in the heart of suburbia. In a living room resplendent with rich furnishings and patterned drapes, a blade of sunlight cuts through a gap in the drawn curtains, directed at Adolescent Anthony as he sits before the TV screen. *Commodore 64* at his knees, discarded software to his left and jewelry freely clasped in his right hand.

It's routine and Anthony's tastes are changing. Green things from outer space are in style as old video cassettes, platforms and ladders have met the same law as used car lots and most adventures offer as many thrills and spills as watching the milk curdle in Auntie Bern's Royal Wedding souvenir milk jug. His pretty graphics scroll before Anthony's eyes, no swamped gag hangs back his ear drums. In their place, stretches a mass of instruments, dials and switches—a realistic representation (depending on which simulator Anthony has loaded into his 64) of the instrument panel of a real, live airplane. In fact, it is so realistic that Anthony is quite oblivious to Rover as he navigates the last remaining paired copy of *Real Over Horizon* (... the one for which, in true Le Carré style, he'd hoped to extort vast sums of money from little Igor Bogdanovich at the Embassy school).

The engine rumbles, the speed and Anthony's adrenaline rise in unison and the altimeter needle swings gradually to the right as the plane leaves the runway, clearing into the wild blue yonder over a patchwork of rapidly shrinking terrain.

Anthony's concentration is momentarily diverted as the sharply stairwinder steps tentatively into the cockpit, his man with a folkwear cap of era. But, our intrepid pilot begins his real and the plane remains on course.

Not for long. As with all good air disaster movies (are there any good air disaster movies?), the hi-jacker enters the scene. This one's a tight short alert. Not only is he trying to show the pilot who's boss, but he even wants to have a go at the controls himself. "Looks like a good afternoon. Anthony reminds me of my days in the RAF," he yells over the radio now. "Did I miss someone?" ... but a quick go ... When I've finished ... "Have look



here, son! who bought you that computer anyway?" What can our hero do in the face of such adversity? Nothing. Force prevails and, with control in the hands of his Bossman, before you can say "bombs away", the wrong fighter and the plane crashes. The dream is broken.

Has the dream flipped her lid? I hear you ask. We know that prolonged exposure to hypoxia has been known to be ruinous to one's health, but we hope the good dear readers she is producing a computer magazine and not a tear-up between a flight manual and a book at bedtime.

Fear not, dear readers. Your Commodore has merely caught a spot of fliggle from this month's mad be the effect of all those VI day celebrations. And this is all a rather convoluted way of

answering our readers, on board for a journey through an environment of flight simulation available for the 64. These cover a very broad spectrum of planes from gliders and helicopters to 747 airliners and satellites.

Having got off to a flying start without reviews, we hope to take you one step further with our air-raising competition—a chance to win not only Atari's Super Match but also one of 50 copies of the newest of the new-flight simulators, *Jump Jet*, which promises to be an excellent follow-up to Atari's already ultra-successful *Flight Path 717*. *Jump Jet* even contains speech, something which any self-respecting computer program should own nowadays. What more could an aspiring pilot ask for?

Over and out.





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1985

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Take our advice and look before you leapt! In this month's bumper special, we bring you page after page of all that's best in the 64 business world.

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A special offer you can't refuse! We publish the complete documentation of the character designer used by Virgin to design the screens of their best-selling games, such as Falcon: Patrol. We also give the actual program to our readers at a price that really is 'virgin on the ridiculous'.



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58

Cheetahs, swift talk their way into the speech synth market...and produce the world's first talk-less RAT.

COMPETITION

COMPETITION 30
Welcome aboard for another high-flyer - this month's competition. We've decided to break with the current trend by not giving away any copies of *Airwolf*. Instead we're offering one flying ace his or her 'air's desire' - a copy of *Super Blotch*. And, to the runner-up, we're giving away duplicate copies of the best in a long line of flight simulators - *Airlog's* jump jet. Checks away!

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TOP 20 Gallup Software

COMMODORE 64

TITLE	PUBLISHER
1 Salt Aid	Various
2 World Series Baseball	Imaginet
3 Impossible Mission	CBS
4 Brian Jacks' Superior Chd.	Marblech
5 Air Wolf	Elbit
6 Poly Position	Atari
7 Rocket Ball	BBK Software
8 Ghostbusters	Activision
9 Crawlfire	Adventure International
10 Bruce Lee	US Gold
11 Zaxxon	US Gold
12 Daley Thompson's Decathlon	Ocean
13 Raid on Bungeling Bay	Artadia Software
14 Pitstop 2	CBS
15 Raid Over Moscow	US Gold
16 Football Manager	Addictive
17 Spy Hunter	US Gold
18 Hunchback at the Olympics	Ocean
19 Spooks	Mastertronic
20 Breakdance	CBS

Retail sales for the month ended May 3rd 1985.



VIC 20 Top Ten

TITLE	PUBLISHER
1 Rockman	Mastertronic
2 Slip the Case	Mastertronic
3 Football Manager	Addictive Games
4 Hunchback	Ocean
5 Mickey the Bicky	Firebird
6 Vegas Jackpot	Mastertronic
7 Bullet	Mastertronic
8 Sub Hunter	Mastertronic
9 Space Scramble	Mastertronic
10 Psycho Shopper	Mastertronic

Retail sales for the month ended May 3rd 1985.

Compiled by Gallup for the industry's weekly trade magazine, Computer and Software Retailing. For details contact John Ross, Computer and Software Retailing, 212 Regent Street, London W1R 3AB, 01-44 2121.

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ULTIMATE PLAY THE GAME, The Green, Ashby-de-la-Zouch, Leicestershire LE65 5JU
(Post are included) Tel: 0530 411405



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1000000	1000000	1000000

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DATA STATEMENTS



When no news might be good news

WE CONCLUDED THAT THE SCARCITY of news on these pages may be attributed to one of two things – either, all the software houses in the country have gone bust, and nobody's told us, or all the goodies are being held in store for the Summer show season.

The first show of any interest to Commodore users is the 1985 Commodore Computer Show to be held in Hammer Smith on the 7th, 8th and 9th of June, 1985. Commodore fans are expected to attend the show. Commodore are hoping to attract such a crowd with three 'three machines-in-one' computers – the 128, on sale to the British public for the first time. Other attractions will include a computer games prize and a separate business section and even (as a...) 'celebrity appearance by (mystery person)'. Even asked? – well, computer challenge competitions, prize draws and a Music

Makes orchestra.

Prize for the 'big show' (that's even bigger than a 'mega-show') of the year must go the Personal Computer World Show to be held at Olympia, London from 4-8 September. This seems, for trade buyers, business and professional audiences as well as all home computer owners and enthusiasts. Not added with last year's one half, the exhibition will now spread their wings over two halls – home computing in the National Hall and business in Olympia 2. Commodore are already amongst those who have accepted the kind invitation to attend. The emphasis is on advice, especially to the business end of the market, which will be given through seminars and individual attention at the NEC Microsystems Centre, for example. What new offerings there will be on the home front, we shall have to wait and see.

From Uncle Sam to Ramjam

THE RAMJAM CORPORATION, creators of the excellent 88 adventure, 'Valley of 17', are to some a three year sentence under the auspices of Activision. They are following in the footsteps of American companies Electronic Arts, Broderbund and Batteries Included, but are the first British company to sign an exclusive licensing agreement with Activision.

Ramjam's next offering is entitled 'Three Days in Casper's' and is supposed to be 'sophisticated, witty and very different'. Time will tell.

Ramjam spokesman, George Stone, is certainly happy with the new set-up. He sees it as an opportunity to stick to what he likes doing best – producing games – while the big boys get on with the job of making a profit.

Activision, Suite 188/189, Asphalt House, Palace Street, London SW1E 5HS. Telephone: 01-408 8729.

Heath is House bound

GEOFFREY HEATH HAS SWITCHED ALLIGANCE from Activision to Melbourne House, where he will be Managing Director and a member of the Board of Directors of the company.

Melbourne House have a staff of 10, including 20 full-time programmers, and already have a fine reputation for producing top quality software. They are hoping that Geoffrey Heath will bless their games with some of that magic which has already made Activision one of the foremost producers of software games. "We feel extremely positive about our position in this very competitive industry and ... are confident that Geoffrey's appointment will greatly benefit our company and its goals", says Alfred Kilgrem, Publisher and co-founder of Melbourne House.

Melbourne House Publishers, Castle Yard House, Castle Yard, Richmond. Telephone: 01-960 6284.



Get netted

MICRONET IS DOING ITS UTMOST to entice Commodore users away from Compuserve. Having realised that many Commodore 64 programs are not being distributed in an efficient and simple way, they reckon they've come up with a solution.

Micronet 800 has commissioned TJ Computing Ltd to design a new protocol to make uploading telesoftware easier and downloading more powerful for a wider range of commercial Commodore software. Micronet believes that the new uploader has a success rate of 90%.

Many of the programs uploaded to the new protocol can still be downloaded to the new protocol and, if you bought a cartridge before the change, those generous souls at Micronet will send out new terminal software free of charge. Micronet has given details of the new protocol to a number of manufacturers producing 64 hardware and expects modem manufacturers to adopt the standard.

In a further bid to attract Commodore users, Micronet has established a new communications package for the Commodore modem user. They have rewritten their Prestel terminal software for

Compuserve members to include a downloader written to the new communications protocol. Previously, Compuserve members could only obtain a Prestel terminal package that didn't download any Micronet telesoftware. But, many Commodore modem users weren't joining Compuserve so Micronet distributed a complete terminal package for the Commodore modem, thus allowing any Commodore modem user to join Micronet without joining Compuserve.

Micronet 800, Telemat Ltd., 8 Herby Hill, London EC1R 5BL. Telephone: 01-275 3143.



Sing-along-a-Mixer!

MICRONET HAS A LOT TO ANSWER FOR! Following in the wake of his stage and film debut, he is now to be immortalised on cassette or disc.

Commodore hope to teach building machines to play a wide range of music with the latest addition to their Music Mixer software. There are three versions of albums - pop hits including Rod Stewart, The Animals or Altona, for example, the Beatles and popular classics. The songs are accompanied by a master track, and an instruction booklet is provided with the software.

Although the software packages have been designed for use with the musical keyboard overlay provided with the Music Mixer program, each package may be used individually. Compositions may be played in one of four modes: Concert, Rehearsal, Single Key and Performance. Tuning and tempo may be selected and MIDI, Omni, Poly and Mono modes allow the program to be linked with MIDI synthesiser keyboards. And, if you really wish to commence battle with the neighbours, you can interface the computer with a hi-fi system.

The Music Mixer 'Play Along Albums' cost £9.95 each and are available on cassette or disc.

Commodore Business Machines, 1 Huxton Road, Wexham, Crowthorne, Berkshire RG2 7 1QR.



Stamp collection

Obnoxious too, it also preside in the Your Commodore col- in fact, in the offices of all the magazines published by Angus & Robertson.

Being such highly popular people, we receive stacks of fan mail, postcards, letters, requests for shopping lists, etc., every day. And, as it is common to every envelope? Yes - a stamp. Well, instead of cluttering up the office box with all these stamps we've been using them for a good job.

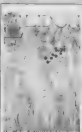
Real, we're not quite as popular as we like to think we are. We need a total of over half a million stamps to sponsor the

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Without any one stamp, this is going to take us an incredibly long time! This is where you, and those ted readers come in. Why making the kindness of both dog and owner when your stamps can help speed up the process! If you receive a lot of mail, or even if you can save stamps from your personal mail, please send them in to our A&R Guide Dog Angus.

Please cut out two stamps, leaving approximately 1cm around each edge, put them in an envelope and send them to: Guide Dog Stamps, Your Commodore, No. 1 Colston Square, London W1R 1AB.

A likely tale



COM-M-O-D-O-R-E 64

ORPHEUS

ONCE UPON A TIME, IN THE BOWELS of the four Commodore offices, there sat a bored young journalist. Searching for some light relief from the tedium of pumping news into his flimsy new word processor (wouldn't thinking - and if this is a fairy story - bored young journalists), he opened a box. "Wasn't any old box, man," says Orpheus' new game, *Edon*.

Thereupon, she loaded the game. The screen was painted with a forest, a mountain & a large hole (lined around the seven faces of Edon), through hundreds of detailed forest glades, in search of the seven magical fountains of Immorta. On her magical journey, in the face of many slurs, and under taxes, she was accompanied by the editorial master of *Comg*.

To reward that a team of independent graphic designers, artists, interface programmers and musicians can add five magic powers to Immorta of spending 5 months in the crypts of Orpheus, developing the game.

But, a though Immorta may talk at the bottom of your garden, Immorta games don't grow on trees. At \$5 is the price to pay for this fantastic journey.

And, should you have trouble buying a ticket, Orpheus may be contacted at the lovely, Ltd. 8, Church Lane, Harley St. George, Nr. Sandy, Beds. SG7 9 1AP.



Errors

In our review of Commercial Products Numeric Keypads (June issue, "Push-Are Pull-In"), page 28, we borrowed the fact that the keypad keypad does not have a RETURN key. But, a spokesman from Commercial Products with good us that our reviewer had no right to complain - the keypad does have a RETURN key. It is marked as an error in the sign-hand bottom corner of the original picture.

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YOU



007

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Enterprise 64
and watch out for
Amstrad, MSX and others

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 1920-1930

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Keywords: child sexual abuse; disclosure; self-blame

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Take to the skies with John
Farrar as he zooms on a
selection of Commodore
flight simulators.

MY FIRST ENCOUNTER WITH A COM-
modore flight simulator was a *Piran*
program on a friend's Z602. Considering
the limitations of the computer I thought
it was amazingly realistic. From that
moment the hunt was on for a
comparable program. It's been a long wait
but it's been worth it for now there is a
veritable barrage of flight simulators on
the market.

The flight simulators are in varied as
the types of aircraft on the shelves. I have
divided them into groups - based on
military aircraft, airlines and so on, if
plenty of aircraft is more to your taste, then
opt for the military versions. Or, should
you wish to go responsible for 100
passengers then try flying a 747. The light
aircraft versions, especially the *Sublogic*
program, provide an excellent
introduction to flight and navigation
in general. So, let's strap ourselves in tight
and take-off into the wide blue yonder.

Military aircraft

The McDonnell Douglas F-15, as fighter is
a high performance aircraft capable of
speeds in excess of 1,300 mph and a
ceiling of 65,000 feet. To match the
performance, its weapon and defence
systems are equally impressive.



There are two programs available for
the aircraft, one being *Highway Pilot* from
Ogar-Integration. This program provides
a menu of options enabling the user to
select: instant action, combat practice,
combat, bad weather etc. All very useful
and each good fun in their own right. The
main combat task is to shoot down a

HIGH FLYERS!



bomber which is hell-bent on destroying
your airfield. If you succeed another
appears on the scene and so on. There is
an on-board guidance system to help
locate the enemy. This is backed up by a
detailed map which shows your position
relative to the enemy aircraft and your
airfield. If you survive long enough, as
the bombers chew back, the *highman*
will become critical, creating the need to
land - assuming there is an airfield still in
fact of course. Weapons and a landing
system are available but it is not easy. The
displays are well done and more fun use is
made of sound and graphics throughout
the program. This program has had
deserved success since its launch some
months ago. For a fuller review see the
April issue.

The other program based on the F-15
is *Strike Eagle* from US Gold. In *Strike Eagle*
the weapons are limited to cannons but in
Strike Eagle the full weapon has been
incorporated including head-on displays
in the cockpit view. Bombs, cannons,
rockets, space fans, electronic jamming
- they are all here, how we loved them,
plus all your luck and skill, as there are 6
different missions to complete. The idea is
that you destroy the primary targets on
each mission but you will have to contend
with enemy aircraft firing anti-air
missiles and SAM manouvres firing heat-
seeking missiles.

Little fighter But there are no take-
off or landing sequences. Assuming that
you survive long enough, you are
airborne throughout. To refuel and re-
arm it is only necessary to fly over your
home base. Varying levels of difficulty can
be selected, with the easiest, *Arcade*,
providing a permanently horizontal
horizon. The graphics and sound are
excellent and the aircraft responds
immediately to control movements. The
excellent 16 page manual states that "The
F-15 cockpit is a complex and useful
working environment". They are not
 kidding! I reviewed this program in detail
in the May issue.

The final program in this category is
Spitfire 40 from Microsoft. There are just
three scenarios to choose from: practice,
combat practice and combat. You are a
young Spitfire pilot in 1940, and must
undergo thorough training before going
into combat against the might of the
Luftwaffe. So, once again, plenty of
practice is required.



Three displays can be turned up the
instrument panel, which is ordinarily
done, the view from the cockpit window
and finally a map of the South East of
England. The scale of the latter can be
altered, which is useful, as it is used to
locate your airfield and the enemy
aircraft. I was not too keen on having to
toggle between the instrument and
cockpit displays, as I found it broke the
continuity of the programme, particularly for
landing approaches. However, if it was





necessary in order to provide such an excellent instrument display than I'll put up with all it could have been the aircraft, shown on the map, to move, but the manual states that this is a means of providing a 'puzzle' in the program, which it does. Oh well.

The program aims to simulate the flying characteristics of the Spitfire and the most delights of those 'famous five'. It really achieves this with excellent use of the bit's graphics although the sound can get a bit monotonous on a long sortie. One good idea is the ability to save your flying time and 'fifty'. I would love to see more use of this facility. The accumulation of hours and skill raises your rank through the R.A.F. 66 hours and the rank of Group Captain allows you to enter a Monarch competition, do 'Tally Ho! chase'.

Airliner

Flight Path 747 by A. King has been around for some time now. The objective is to takeoff from the home airfield, fly over some mountains and, and the other side, there's all there is to it! There are the usual sorts of, if flimsy, but the sound is hard enough. The cockpit instruments are all the display type and are clear and concise.

From takeoff to the landing approach sequence, it is necessary to keep within the parameters for various controls. For example, the flaps cannot be raised before 800 feet and at less than 140 kts. The instruments are well drawn and the graph in and sound are adequate. I landed along the approach with the runway, at the start of each flight, a little tedious. My mail is in with some odd ups (eg an error message 'ACCEPT TO SLOW') but this is a minor fault. The credits later claim that this is an 'Advanced flight trainer' which I think is going a bit far. Nevertheless, I found this program to be good fun and very addictive, which is, after all, what software should be.

Doctor 'ah's 747 flight simulator was written with the assistance of a British Airways Captain, this program allows you the freedom of the north eastern European air routes. Starting initially from

Heathrow, you can select your destination and, assuming you have developed the necessary skills, you can store the data to your hard's console using navigation beacons.

The Keyboard controls are neatly allocated (thrust/brake/flaps etc) and precise motion are available. When the joystick is moved left or right, the horizon tilts accordingly in the simple, 3D view through the window. Instruments and controls can be reset to alter cloud base and top, day or night flight, wind speed, and the starting point can be changed.

An added feature is a fantasy score with word shapes and effects against over the horizon sea. The documentation fully describes each of the options on our screen.



London jet controls become the main concern to users of **DAFC's 747 flight simulator**. The engine gauges alone give the individual status of each engine in regard to speed, fuel, temperature, pressure ratios and fuel flow. Flaps can be partially extended, ailerons and elevator positions are shown and a warning panel flashes signals to the pilot of impending trouble, emphasised by an audio signal.

One documenting feature of this program is that although the artificial horizon on the instrument panel indicates that the jet is banking, the view through the cockpit window remains resolutely horizontal.

Navigation is performed with the aid of a simple direction index, leaving the pilot to worry about landing preparations.

The flight manual gives full instructions on the purpose of each gauge but a few words on flight principles would not go amiss.

Varied

The variety in this section are as different as chalk and cheese. One sees, here is a helicopter and the other for a glider.

The helicopter simulator is **Super Huey** from L&L Global Translaid and that is

also available from Audigenix (at a low £1 less than the £17.95 for Super Huey). Helicopters are a familiar sight in the skies over my home, in NW Cornwall, with hardly a month going by when we don't hear that another disaster rescue has been carried out. The latest rescue of a few years ago windy springs to mind. Therefore, it was with eager anticipation that I loaded in Super Huey for the first time.

As with most of the flight simulator already mentioned, Super Huey is accompanied by a comprehensive flight manual. Once again, extensive reading is not only required but a different kind of flying - altogether. You will learn some like cyclic mode and collective mode, which relate to the control of the rotor blades and the tail rotor. A joystick is a must for this program, preferably with the full motion on the top, as it is used to toggle between modes. There is the customary practice session to help you 'get off the ground'. The on-board computer guides you through the stages of take-off, flying and landing. At this point I have to say that the graphics and sound effects are stunning. The cockpit display is incredibly detailed and, as the helicopter gains height, surrounding buildings and radar search domes in use. Having the stick forward provides forward momentum and soon trees and bushes are whizzing by the cabin screen. Climb to over 3000 feet and they disappear from sight. All the while, you are accompanied by the familiar sound of the engine and rotor blades. Great stuff!



This sets you up to tackle the other missions on the program. There are Rescue, Combat and Diplomacy. As they have to be loaded separately, it is necessary to record the tape counter readings in order to quickly locate each program. I have to say that, after the promise of the training flight, I found

more other means to be a great disappointment. The manual, which explains the physics of helicopter flight in some detail, does very little to help us how to manoeuvre the machine. Furthermore the on-board computer and radar systems (particularly helpful). The graphics on Rendu are awful, bearing no resemblance to modern realism at all. In Combat, the fire button fires the torpedoes and cannons, but it also controls the aircraft! It is necessary to type three letters to move the compass/gyro (RAD for Radar, for instance, surely, just R would have done) to add sonar, the program surely needs to keyboard process as it should.

It is almost worth buying the program for the training flight alone but I have to say that it is a great shame that the other missions were not better implemented. Perhaps there is a MIDI version on the way? I hope so.

Clicker Pilot by CBI provides the user with just one task - that of flying a triangular course of approximately 100 km. To provide variation to this objective, the program has five levels of weather conditions from which to choose, or you can program your own.



The manual explains the technique of manoeuvring (lefts and starts) in sufficient detail for the uninitiated, the program takes some time to load and, having done so, the most awful monotonous tune comes out. Perhaps it gets better but I never learned beyond the first few notes!

Once the phase of weather conditions has been made, you find yourself at about 1,800 feet, close to the start line. Crossing the start a clock starts as you are competing against time. The graphic display of the analogue cockpit instruments (all for short of what one expects these days. The clocks,

where the thermals that provide lift for soaring are found, are very chunky in appearance; spaces should have been used for these. To give the impression of movement, an attempt has been made to provide 3D perspective ground details. A good touch is the provision of a data read graph showing the vertical path of the glider through the air.

For those already with a declared interest in gliding there I would think that this program would have come apart! For the rest, I would say that the program would seem to need to be shelved due to lack of adequate questions. At all times you would certainly need to be among the former group.



Light aircraft

Solo Flight by Microspace was one of the first flight simulators to appear for the £4 to the home, some 18 months ago. Since then it has had deserved success in the UK. The aircraft, in this simulation, is a single-engine, 1940 vintage monoplane. But this model is fitted with up-to-date VOR navigational aids. The cockpit graphics are adequate, if a little uninspiring, but everything is clear and concise except for the artificial horizon display which is too small. The simulator differs from all of the others in that you are flying an aircraft in front of you. The cockpit instruments and the view out can be seen, while in the distance is the aircraft that you are flying! After the others, it is taken getting used to, but it, nonetheless, very enjoyable to fly.

The program loads quickly and then provides options of three areas, Kansas, Washington or Florida. The former has flat terrain and the latter hilly terrain. There are six levels of the varying weather plus a Mail Run game. In this it is necessary to deliver bags of mail from one

airfield to another, against the clock and increasingly bad weather. The aircraft is also liable to mechanical failure.

The manual covers all of the operating characteristics of the aircraft and also explains, in some detail, the techniques of VOR navigation and navigation (yep). There are maps are included to help locate the many airfields but I felt that they could have been larger and more detailed. Nevertheless, this is a very enjoyable program, with enough options and built-in 'Aids' to keep you amused for hours. I understood that a MIDI version is to be launched soon so it was a welcome opportunity for a test flight. If Solo Flight (MIDI) has been improved, it will be very, very good.

To say that I am a fan of the next program would be an understatement. I refer to **Flight Simulator II** by Sublogic. I could take up most of this magazine explaining the finer points of the program but let me give you just a taste.

The aircraft simulated is a Piper Cherokee Archer, which is a single-engine, fully aerobatic aircraft. The program comes with two manuals, each of 90 pages. One covers the workings of the program and fundamentals of flight and navigation, the other covers flight physics and control in greater detail. In addition, there are four extremely detailed navigation maps covering the areas of Chicago, Los Angeles, Seattle and New York/Atlanta. It is possible to point on the aircraft at any of 60 airports in these areas, and fly between them.

The instrument display graphics are exceptionally detailed but the 3D (and, not used) perspective cockpit view is somewhat else. One of my favourite 'tips' is to take off from Kennedy International and park in the Empire State Building, the United Nations level blocks and out into the Sound has the Statue of Liberty in the distance. Sound is equally impressive.

Using the comprehensive 'loading' menu, it is possible to set up any parameters you require. Clouds at two levels, three levels of wind height, speed and direction, rain surface level. Time of day and seasons of the year can be set. Any position and attitude of the aircraft can be pre-programmed and all this can be saved into another model disc if desired. There are nine preset routes (though).

Finally, there is a World War I combat program included for some bombing and shooting practice from a biplane. Quality work as it's done not come cheaply but, my goodness it's worth it.

Flight simulators require the comprehension and coordination of arcade games, the strategy and skill of adventure games, with the player in a quasi real-life situation. I find them fascinating and absorbing as I'm sure you will. Happy landings!

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MANY COM OWNERS WHO USE BASIC only will, sometimes, get frustrated with the limitations of the language. This is particularly true of younger users who wish to emulate the authors of arcade games. Short of learning assembler to a fast language such as FORTRAN, there is little that can be done to overcome this. The aim behind this short series is to provide a taste of 'ready to use' machine code routines which BASIC users can call to achieve somewhat graph and effects. The routines have two useful attributes:

- 1) They generate examples and are in a fast and efficient manner.
- 2) They help fill the hole left by the weak BASIC.

Rather than re-invent the wheel, I have endeavored to cover new and interesting areas of graphics. As far as possible I will make all of the routines compatible. But, inevitably some zero page locations will be common to more than one routine. This should not provide any problems. The spare area between \$C000 and \$C010 will be used so that you won't loose the RAM.

On with the show

In this first part I want to deal with user defined graphs from a slightly different angle. In Commodore computers, the character data is held in a \$C004. Each character comprises an array of 8 bits and this can be stored as eight variables. Each number defines the pattern of dots in each row of characters. Hence, if you can change these values, you can redefine your characters. Say you'd the video chips in the 64 has a handy little pointer which can be pointed at any character set you want. Additionally, by changing manipulation of the character value, you can perform clever tricks such as scrolling.

The loader in Listing 1 gives a bank of nine routines for the manipulation of characters. Their functions are given in figure 1.

Function	Syntax
1. Set up character set	\$S5-\$B5:Address
2. Delete a character	\$S5-\$B5:Char,A,B,C,D,E,F,G,H
3. Roll left	\$S5-\$B5:Char
4. Roll right	\$S5-\$B5:Char
5. Roll up	\$S5-\$B5:Char
6. Roll down	\$S5-\$B5:Char
7. Invert	\$S5-\$B5:Char
8. Reverse	\$S5-\$B5:Char
9. Clear	\$S5-\$B5:Char
10. Back to front	\$S5-\$B5:Char

Figure 1



Program Listing 1

```

1 SET CHARACTER RECALL/ROL
2 SET
3 ROLL LEFT 180
4 SET
5 *****
6 *****
7 *****
8 *****
9 *****
10 *****
11 *****
12 *****
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86 *****
87 *****
88 *****
89 *****
90 *****
91 *****
92 *****
93 *****
94 *****
95 *****
96 *****
97 *****
98 *****
99 *****
100 *****

```





The first command sets up a redefinable character set at a specified address. This address can be any of the permitted locations allowing the use of any of the buses. Figure 2 shows how to set up a character set at \$C000, lines 10 and 20 change the bank and line 30 moves the screen to \$C480.

SETPOINT GRAPHING METHODS
\$P0A 10000,0000,0000,0000,0000
\$P0A 1000,0000
\$P0A 1000,0000,0000,0000

The remaining commands alter the speed of characters, with the second command redefining any character and the eight parameters specifying each of the eight lines of the character.

The function of the next four commands are self-explanatory. Line 1 shows how a number of effects can be achieved by the selective scrolling of selected characters. The behaviour of the colour characters when scrolled is particularly interesting.

The screen and 'back-to-forward' commands are handy because they let you use a single design for several characters. This is very useful if, for example, you want to have a figure moving back and forth across the screen. Next month I want to tackle a slightly more obscure area. Most action games use colourful effects to portray explosions or items from one screen to another. I will give some simple routines which can be used to give some interesting effects to your games.

Superdancing 1

```

10 SET
20 SET 1000 1000 1000 1000 1000
30 SET
40 SET 1000 1000 1000 1000 1000
50 SET 1000 1000 1000 1000 1000
60 SET 1000 1000 1000 1000 1000
70 SET 1000 1000 1000 1000 1000
80 SET 1000 1000 1000 1000 1000
90 SET 1000 1000 1000 1000 1000
100 SET 1000 1000 1000 1000 1000
110 SET 1000 1000 1000 1000 1000
120 SET 1000 1000 1000 1000 1000
130 SET 1000 1000 1000 1000 1000
140 SET 1000 1000 1000 1000 1000
150 SET 1000 1000 1000 1000 1000
160 SET 1000 1000 1000 1000 1000
170 SET 1000 1000 1000 1000 1000
180 SET 1000 1000 1000 1000 1000
190 SET 1000 1000 1000 1000 1000
200 SET 1000 1000 1000 1000 1000
210 SET 1000 1000 1000 1000 1000
220 SET 1000 1000 1000 1000 1000
230 SET 1000 1000 1000 1000 1000
240 SET 1000 1000 1000 1000 1000
250 SET 1000 1000 1000 1000 1000
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A.P. and D.J.

Stephenson explore
the mathematical
capabilities of
programming in
BASIC.

T · H · E E · N · G · I · N · E F · A · C · T · S

PART 10

THE BASIC LANGUAGE TAKES many mathematical functions. Highly complex programs can be programmed with ease and tested with real figures without the customary arithmetic drudgery. The mathematical commands on the Commodore machines are powerful and capable of doing a complex equation but it is easy to fall into traps caused by such items as run-in-by-two, signed roots and unexpected rounding errors.

Translating text book equations

A text book equation can rarely be directly implemented in BASIC. For example, $\sin^{-1}x$ written in BASIC must be written as $ASN(X)$ because there is no provision in BASIC for positioning a variable "up" in the air. Multiplication is indicated by "*"; the equation $3x+4$ must be changed to $3*X+4$ else the computer will think that 4 is the name of a single variable and an upward key will be created.

Equations within functions must be enclosed in brackets, even though they may be optional in the text book version. For example, a mathematician would write $\cos(x)$ or $\cos X$ but we must translate these to $COS(X)$ and $COS(X)$. In BASIC, a function is a special keyword, characterized by the inclusion of brackets around the variable. It is used to supply the language with a line of the commonly used mathematical operators other than addition

subtraction, multiplication and division such as $COS(X)$, $TAN(X)$, $ABS(X)$, etc.

Degrees and radians

The circumference of a circle is divided into 360 parts. However, BASIC trigonometric functions expect angles to be measured in radians. Thus, $TAN(45)$ is asking for the tan of 45 radians. If you prefer to work in degrees, position one a key for converting radians into degrees for example

The trig functions, $SIN(X)/2$, $COS(X)/2$ and $TAN(X)/2$ will work if X is entered in degrees.

Logarithmic functions

Some BASIC dialects offer two log functions, one to base 10 (common log) and the other to base e (natural or natural log) but Commodore 64 BASIC only offers the latter.

$LOG(X)$ means the log to base e. The number equivalent to be expressed exactly, however many digits are used, but $LOG(X)$ is accurate to 5 digits. It is a strange number which can be calculated to any order of accuracy by use of the series:

$$x = (1 + 1/x) + 1/2x^2 + 1/3x^3 + 1/4x^4 + \dots$$

The more places you take in the calculation, the more you will get to the true value. But don't go too far, if you calculate the

series to, say, 25 terms the number of digits equal zero exceed the calculating precision of the machine and are further additions would be meaningless numbers.

The exponential function

$EXP(X)$ returns a value, x where x is given. $EXP(X)$ etc. The function does up to 1000 times as many active decs, averaging precision and population statistics. This is also an important number of a group known as hyperbolic functions.

Inverse trig functions

$ATN(X)$ is the only inverse trig function directly available since it is the one most commonly needed in practice. But the range can be extended by using some standard conversion formulas. We have arranged the formulae in dot and functions so they can be entered directly.

$DEF FNABS(X)=ABS(X)/SQRT(1+X^2)$ for values of X less than 1.
 $DEF FNACD(X)=ATN(X)/MGR(C/2)*57.3$ for values of X less than 1.

We have named the functions AS and AC respectively.

Hyperbolic functions

Normal trig functions are based on the circle. Hyperbolic functions are similar but are

based on the curves known as hyperbolas.

They are not directly available but can be obtained from standard conversion formulas. They are set out below as defined functions and are true for all values of X.

Hyperbolic sine
 $DEF FNHS(X)=(EXP(X)-EXP(-X))/2$

Hyperbolic cosine
 $DEF FNCH(X)=(EXP(X)+EXP(-X))/2$

Hyperbolic tangent
 $DEF FNHT(X)=(EXP(X)-EXP(-X))/(EXP(X)+EXP(-X))$

We have named the functions HS, CH and HT respectively.

Use of brackets

When writing down algebraic expressions, we can rely on operator precedence, as the following

- 1. raising to powers
- 2. negative numbers
- 3. multiply
- 4. divide
- 5. add/sub
- 6. subtraction

Examples
 $1+2*3$
 $1+2*3+4$
 $4*3+5$

However, to avoid errors, it is better to use brackets liberally than to rely too heavily on operator precedence.



Subroutines or defined functions?

In general, the defined function is faster and more economical than writing equations in the form of separate subroutines. In fact, the defined function is tailor-made for the job, of being local protection for parameter symbols. One reminder—the function must be declared with `DEF FN`, before it is called with `FN`. Since the defined code only be executed once, however many times included in a list created as a normal non-task and placed near the top of the program.

Handling simple equations

The majority of equations in technical books present little difficulty. As a simple example, we will take a well-known relation from the field of electron to illustrate some of the pitfalls. The formula, as it would appear in text books, gives the frequency of a series of resonant electrical currents of an antenna: a clear what this is or not but it is given merely as an example:

$$f = \frac{1}{2\pi\sqrt{LC}}$$

An equation, not just the text, should be examined to see if there are certain values of the variable which could cause a crash. We begin by re-writing in a form acceptable to BAS-C:

$$FBN=1/2/3.14159/((C*L)^.5)$$

This will work OK but, if the equation is to be entered along with several many times, the term in the denominator, $2/3.14159$, must be performed before the exponentiation if it were, say, C^2/PI somewhere, the equation can now be written:

$$FBN=FN/2/3.14159/((C*L)^.5)$$

We may then decide to put in our defined function form:

$$DEF FN(L,C)=1/((C*L)^.5)$$

The name of the function is `FN` and the formal parameters are `L` and `C`. Later, we may replace the function with, say

$$FN=1/2/3.14159/((C*L)^.5)$$

where `L` and `C` are the actual parameters. The result also runs over direct constants:

$$FBN=1/2/3.14159/((.0001*.0001)^.5)$$

If `FN` was printed for 4 decimal places, we should get `7.957747`. Watch out for the following:

`L` or `C` or both can be zero in the denominator because the square root of zero is a real number but the machine would not support the error message "DIVISION BY ZERO" because 1/zero is infinity.

None of these happens, the result is usual and would trigger the message "BASICs, QUANTITY".

But, if both are negative and not zero, the product of `L` and `C` would not be acceptable by the machine.

Scaling problems

The `SI` system (Systems International) has been used in technical colleges and universities for many years. Whatever system is used, there will always be some which are too large or too small for practical measurement. Electronics abound with astonishingly large and small units. For example, the `SI` one called the farad is so gaudy that the total capacitance of the planet earth, treated as a perfect conductor sphere, is only one quarter of a farad. In practical electronics, even the transistorized one-millionth of a farad is a relatively large unit and capacitances of a few picofarads (one million millionths of a farad) are not at all unusual.

Values last these present difficulties when trying to write our heavily programs. For example, it would be more practical to input the value of capacitance in terms of millionths of a farad only. But, you can get into a right old time by re-writing equations using multiples or submultiples of the unit. The sales way is to convert all values received from our friendly keyboard input immediately into standard `SI` units, leaving them in this form until all calculations are finished. For example, our previous formula

for series resonant frequency is only true, as it stands, if `L` is in Henrys (1 unit of inductance) and `C` is in farads. A suitable request for keyboard input might be:

```
100 INPUT "ENTER INDUCTANCE IN HENRIES"; L
110 INPUT "ENTER CAPACITANCE IN MICROFARADS"; C
120 FN=L/1E6/((C/1E6)^.5)
```

Line 120 converts the denoted by Henrys and microfarads to farads, ready for direct implementation into the standard equation. Although we have recommended that units should remain in part 51 throughout the length of the program, when the user comes to print out results, the unit can be converted back again to more practical values. Thus, if the result of our equation for `L` was `40000` Hz, it might like to present the kHz (1000 Hz) so we could write:

```
130 FN=FN/1000
140 PRINT "L= ",L/1000,"H"
150 PRINT "C= ",C/1E6,"uF"
```

If you follow these guidelines, you reduce the chance of a crash even being a remote possibility, out.

Quadratic equations

Many readers might be familiar with the following relation for the two general solutions:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}, \text{ then}$$

The presence of the square root in the equation implies that some values of the coefficients `a`, `b` and `c` can give several solutions because mathematicians have decreed that the square root of a negative number cannot exist. The condition for general solutions is when `b` is negative than `b`. The expression within the square root is when known as the discriminant because it discriminates between real and unreal solutions. When writing equations which involve the solution of quadratics, it is wise to evaluate the discriminant part of the equation immediately because

if the result is negative, there is little point in proceeding further.

But, a novel root does occupy an important position in the theory of alternating currents in general and the behaviour of auxiliary current signals that the two degree equation allows the two general solutions of a quadratic to be expressed in the form:

$$R_1 \pm jX_1 \text{ and } R_2 \pm jX_2$$

Any quantities produced by `j` are the general parts of the solution. Solutions, which contain a combination of real and unreal terms are known as complex solutions. In order to get the computer to accept complex solutions, you must first the distribution as before but, instead of division, convert it to the absolute value using the command `ABS`, in other words, change it to positive which is equivalent to reversing the terms within the discriminant. To compensate for this trickery, the operation `j` must now be a label indicating that such a quantity has been carried over. The equation needs to be a little re-arranged so that the real and unreal terms are separated.

$$\begin{aligned} \text{Solution 1} & \quad \frac{-b + \sqrt{b^2 - 4ac}}{2a} \\ \text{Solution 2} & \quad \frac{-b - \sqrt{b^2 - 4ac}}{2a} \end{aligned}$$

The character `j` is just a strong character which can appear only on the final part of the solution. It can take no part in computer calculations.

Polar and cartesian coordinates

A point in two-dimensional space can be expressed in terms of polar coordinates or cartesian coordinates. In fact, we can convert 10 miles on a bearing of 45 degrees, or in terms of polar coordinates, to cartesian co-ordinates by using a certain value for 100 miles, then take the last three on the right and walk a further 10 miles, we give us in terms of cartesian coordinates. A common reference on these directions should convince you that polar coordinates are



swamp in an aircraft or in the middle of the desert but, in a typical city, the destination could only be reached by walking through the maw of buildings.

Polar coordinates measure the distance of a line from a fixed reference point and the angle of the line to a fixed reference line. The distance (length of the line) is called the modulus and the angle is called the argument. Polar form co-ordinates can be expressed in the form Z (the modulus) and θ (the argument).

X-Y (angular) coordinates define a point in terms of its X and Y coordinates. Figure 10.1 shows both forms.

Converting Cartesian to polar
 $Z = \sqrt{X^2 + Y^2}$ $\theta = \arctan(Y/X)$

Example: If $X=5$ and $Y=4$, then
 $Z=6.4$ and θ is 37.5 degrees.

Equivalent programmed
 function

```
100 DEF FNAB(X,Y)=SQR(X^2+Y^2)
110 DEF FNA(X,Y)=ATN(Y/X)
```

To use the function

```
100 Z=FNAB(5,4)
110 A=FNAB(X,Y)
```

To convert from polar to
 Cartesian

$X = Z \cos(\theta)$ $Y = Z \sin(\theta)$

Example: if $Z = 5$ and $\theta =$
 30 degrees, then $X = 4.33$
 and $Y = 2.5$ in 3.14159.

Equivalent programmed
 function

```
100 DEF FNAC(Z,A)=ZCOS(A)
110
```

The function name is XC, if
 Cartesian

```
110 DEF FNAC(Z,A)=ZCOS(A)
```

The function name is YC, if
 Cartesian

To use the functions
 100 X=FNAC(Z,A)
 110 Y=FNAC(Z,A)

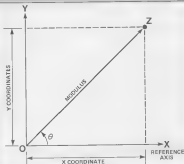


Figure 10.1 Polar coordinates (Modulus and θ) and Cartesian coordinates (X and Y coordinates)

Statistics

Statisticians supply us with figures, derived from well-proven probability laws, but leave us to interpret them in a common sense manner. It is incorrect interpretation, often quite deliberate, which leads to the image of statisticians that renders them a focus to politicians and advertisers.

If you present statisticians with a sample of seemingly random figures, they will come up with some predictions but mixed with caution. For example, the sample may be too small for reliable predictions to be made. Statisticians will do with samples the larger the sample, the better the confidence factor that the sample results can be extended to the total population. (The term 'population' refers to the total number of items, not necessarily people.)

Collecting the data

Data, as far as statisticians is concerned, is a set of numbers.

When the numbers stand for a set of things of importance to statisticians, the set of numbers could be those sizes or the distance between the head and arrow of a sample of people. The collection of data is normally a field exercise, the end result being sheets of paper. The figures on the paper will be entered into a computer and one or more statistical formulae brought to bear on them. It is a common requirement to find the mean value and the standard deviation of a set of figures. To find the mean value, just add up the numbers and divide by how many numbers there are in the list. The standard deviation is another matter and demands more explanation than we have space for. The formula is usually expressed in the following form:

$$\text{Standard deviation} = \sqrt{\frac{\sum (X - \bar{X})^2}{n}}$$

where \bar{X} is a value of the mean value
 \sum is the symbol for the sum of
 n is the number of items

We include it because, of all the statistical operations available, it is the most useful and probably the most well-known.

Factorials

The factorial of integer N , written $N!$, is the product of all integers from 1 to N . For example, $4! = 4 \times 3 \times 2 \times 1 = 24$. Factorials have a ready habit of leading to astronomical values with even moderate values of N . For example, 100 factorial is 3.628,800 to one problem to which can be a solution. The difficulty is nearly reached with 10! because it has an approximate size, 3,628,800. A strange feature of factorials, representing another possible hazard, is that $0!$ and $1!$ both = 1. Factorials figure prominently in the laws of probability and combinations, which concern up statisticians with football pools, horse racing and so on. It is not surprising that putting it into a computer.

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Jump Jet for the Commodore will arrive for release at the end of May. It will retail for \$9.95 on cassette and \$19.95 on disk. Lucky lucky prize-winners will be able to simulate mayhem in the living room if they're fed up of the bog with the concert answers to our companion. And, one even-luckier-than-luck is, prize winners will not only win a copy of Jump Jet but will also be able to throw their own party with a copy of Amiga's Super Smash (valued at \$49.95) - see last month's issue (if our review), lots of how to become rich & lucky prize. Later on.

Jump let it be a gambler and flight a master, written by Vaughan Thomason for many years, was a jump let point. It starts by warning you, and at the same time, all from the hand-off deck of a career. Using a variety of movements in your deck board and your cards, you can locate the money trail. Then it goes on to say - should you think of money to the mind and pursue the money all make yourself a laughing stock by returning to the career with your face between your legs. But, even if you successfully attack and destroy the money, there is only enough for the one journey in you must let me to know what you mean.

There's a jump let in a routine. The old book reflects the tasks in the 18th - 19th centuries. Lieutenant, Squadron Leader, Wing Commander, Group Captain. One obvious plus is the use of sound to relay messages - for example, 'Ready for take-off' being 'contact' or 'low fuel' - messages which for those who can't read

But those who missed out on last month's near-plush feast available from the white-and-gilded towers in a dining hall accompanied by some excellent software and, in our reviewer's opinion, a "breezy and rather good fun" it really has turned out to be more like the old days.



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 216. **Figure 207**
 217. **Figure 208**

truly the purest of our very best Commodore. You get unadorned average pop, that's the work-horse group (open in the air line). Now, even if you are not bright enough to realize that the word Commodore refers to anything other than a computer or a local higher class, you can't fail to notice that there are essential differences between our two persons. But how many? You tell us, but make the difference on the picture of the word classes and not down the

amount. The number of differences should also be written on the back of the envelope in which you send your trip submission (e.g., I sent the photos across a

Now that there are many times as you wish but each entry must be on an official coupon and mailed in a separate envelope. Please write clearly on the coupon as it will be used as a label if you win a prize.

Fill in your surname, name and address on the entry coupon and send it to: Anson Competition, 2001 Concorde, 1 Golden Square, London W1R 3AL. The closing date for the competition is 1st July.

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The Correspondence will be entered into with regard to the competition results and it is a condition of entry that the editor's decision is final.

The How to Enter section forms part of the rules.



Amiga Competition

1st

Up to 1000

Prize...

To the Your Correspondence post bag

1 applied ... of 1000000

Remember to write your answer on the back of the envelope or your entry will be null and void.

Super darts

Our reviewers pass

Judgement on the latest
software goes found lurking
on the editor's desk.

Rock'n'Roll
★★★★
Action
\$19.99 (street)/\$19.99 (list)
CIBM 88 — joystick optional

AT LAST — AN ORIGINAL GAME WHICH rewards you to use your brain, and not just your joystick. The top 10 top-ball games together for each of 100 hours of a new day's game. They do not form a

single grid, but each floor has a complicated layout filling up to three screens. The players move around in a swinging from the pole of a crane, and you need to jump about then roll them down in the correct positions. At this point you find yourself lost off in your game, so you need to undo several balls and think again! The games have to be finished in the right order to get back to the 1st and nearest floor, and while this does require an exercise in logic, there are two screens where you are set against the clock, and these are really challenging! You are paid for the number of balls successfully landed, and your score is the total per-

formance. The game has excellent 3D graphics with very smooth animation, and is accompanied by a good rock soundtrack.

If you like challenging everything in sight this game is not for you. If, however, you are intrigued by the idea of a sort of computerized Mermaids, then it is quite exceptional and not to be missed.

spotlight

Grand Larceny
★★★★
Adventure/Heist
\$19.99
CIBM 88 (joystick optional)

GRAND LARCENY, which will have its house-chiggers just as The Hobbit begins to become a leading literary, takes me, then some out with yet another, excellent adventure game which sets the pace for others to follow.

Grand Larceny is set on the level of a hotel, the Grand the object being, first of all, to get into the place and secondly, to get out again having recovered stolen plans before your time runs out. The player is divided on three: the top part shows the character and his immediate survival; the middle screen

contains textual descriptions of the location and dangers; and a command entry window occupies the bottom part of the screen. Your hero walks at variable speed with joystick or keyboard assistance to hit the locations on the screen in the graphics window, here when open up as doors are opened, items are recorded and so on. Detailed descriptions can be called up at any time with the LOOK command and all the exploration is accompanied by a repertoire of well produced sound effects.

Verbal commands are used in the console entry and while this removes a lot of the fun of finding the right thing to say this is more than made up for by the variety of movements, options and the limited interaction with the other characters in the hotel.

Measured adventures might lead the game loss of a



challenge than they are used to since a good deal of the memory is occupied by the graphics but as a game that offers something a bit different coupled with its own sense of humor it still presents a good package.

The only minor criticism is that there does not appear to be a save option, but since you are presented with a very tight time limit within which to accomplish your mission, the amount of an apple is a nuisance.



Tycoon Tex

★★★★
Comwin Graphics
\$4.95
C16 or Pascal

TYCOON TEX, WE ARE TOLD, IS A room-teen of spooks who, surprisingly, spends his time not with his-dilets but running along his pipeline and jumping over obstacles as if somehow to other the adds a few more milans to his bank balance. He's under frequent attack, but he's not short bank, and gains valuable lessons from destroying barrels for obstacles and other hazards. At the end of each section of pipe, points are awarded depending on the speed at which it was done and. Answer section then beg in, with a different setting and new obstacles.

The game owes a good deal to Moon Duggy but it is quite brilliantly programmed, with first-rate scrolling graphics. There are 99 levels in all, subdivided which vary in difficulty from level to level. There's a screen with a high-score table and various options including a demo mode - the whole effect is very professional and impressive.

This is the first game of its type for the C16/Plus 4, and I recommend it highly. It is, rather, there is not a great deal of variety, but it is a real test of concentration and speed of reaction. So go out your tongue and breathe that pipeline!



Pole Position

★★★★
Atari
\$5.95
Commodore 64 - joystick

UNTIL AS THE WELL-KNOWN Formula One Grand Prix circuit hits the road again with its pole-hopping action, to the midway success of the arcade hits for the past year or so turn us to the screen. And if you're thinking of running with the pack at even starting in Pole Position, then I'll guarantee that you've made the right choice.

This is a great motor racing game and a superb piece of arcade. There are three races you can enter, each with a different difficulty level and, of course, a practice run so you can burn up your id. Before you can race you have to go on a qualifying run and it's one of the tight positions on the starting grid. Best the 71

second time best and you make the grade to run with the elite. Just 38 seconds and you start from the front of the grid in pole position. Racing is realistic with extremely clear graphics of both cars and the track. All the car's control functions are operated through the joystick: left and right to steer, forward to accelerate, the fire button to change gear and back to slow down.

Other drivers make race are both an obstacle and a chance to score points when passed. Oil trail signs (points can also work the car although you can have an unlimited supply of oil) can tell you within the allotted time. Slowing off the track will slow you down considerably and lose you time as well taking the corners too fast will cause the car to skid. Keep up the rest time and prepare to take the chequered flag. Pole Position is a real winner.

344

Petals of Doom

★★★★
Comwin Graphics
\$4.95
C16 or Pascal

GARDEN PESTS ARE A menace, and the vanities found in outer space are the worst of all! Your task is to beat down, and destroy all sorts of a on bugs in 99 generations of space-flowers. By enabling the five plants in each garden to reach maturity, you may proceed to the next level. There are many kinds of alien pests, each of which moves in a different pattern, and some

pose a worse threat than others. On the higher levels the procedure is repeated, but with more bugs to kill. The pests are destroyed by you being at them, while flying above ground with the aid of a power supply in your back pack. Once your business man has you help us into they are exchanged. You may choose to have up to ten lists.

As with other games from Comwin, the graphics are superb and the use of sound is also good. The game suffers, however, from lack of variety and, although a fun to play, I suspect that I would use it of quite quickly. Otherwise it might have earned a fourth star.

345

Sold!

Band And Trail
\$4.99
CIBM 64 (jovetick)

THERE CAN BE FEW PEOPLE UNABLE to get the second Band And has had in saving money for the people of Ljubljana. Sold! is the computer industry's answer to this. Sold! is a collection of ten top games from some of Britain's foremost software houses.

Two are got + we're spotlight



Armed games on the usual console box with a larger than average play card to carry all the game instructions - there is not nearly enough information, but then again there are too games to cover and you can't get War and Peace onto a postage stamp.

At the start of each side Band And have shortened their angle. Try not to load the info into your head, but a little more time. On loading the games I was a little dismayed to find that three titles would not load from any saving attempts I still haven't seen Cavalier, but one rather can almost be understood. Of the other nine there are 11 already short ones, 2 many more, 2 platform/beam games and 1 terminal one called Star Trader.

None of the titles are particularly new but all are good old games, no rubbish, and if bought separately each could command an £8.00 price tag and you wouldn't feel cheated. As personal favours come up to now must be Asteroids's Bomber, a really good old fashioned computer bomber, and Pike by L. S. Gold. Gold's Gold and Star Trader also are worth a mention. All the rest deserve a mention as well - the tape again too good to be true.

Given better instructions, and if all games had loaded, the tape would have received five stars. But still, rapidly should be without this compilation.

Defender

4 4 4
Parker Software
\$7.99

CIBM or Plus/4 - Benchmark only

"GAMES IN THE STYLE OF DEFENDER have been very popular for other machines, though this is the first I have seen for the CIB - and it's a good one!"

This is the ideal game for people with aggressive tendencies, because your task is quite simple to shoot everything in sight. Unfortunately the fun is far from one-sided, - the aliens you are fighting are steady, well-thought creatures, not aware of such duty tricks as creeping up on you from behind or forcing an on the head from your engines. This means that as well as shooting you need to dodge, and this is made more difficult by the mountainous terrain over which you are flying. Not surprisingly, hitting a mountain is just as fatal as making soft touches with Bombers, Landers or Zeal.

The sound effects are very good and the graphics, though not outstanding, are reasonable. The game really looks out, however, by having no pop-out, except for fewer than seven levels are used to control your craft, so after a while your fingers have one sticking-point!

Pressure, though, as the game is well-programmed and worth buying.

Las Vegas

4 4
Amiga
\$6.95
CIBM 64, Plus/4, CIB 64

TO BE HONEST I DON'T SEE THE POINT of computerised fruit machines. It's just not the same as playing the real thing and you don't get the sense of actually winning anything. Having said this Amiga's game is quite playable and there are three versions, one for each computer, on the one tape. Each includes a test and relative technical.

The CIB version's graphics aren't amazing - the reels take up a small part of the left side of the screen, and the rest of the screen is covered in a large number feature grid which has loads of complicated features which each of you get a certain combination.

The VIC version graphics are better, taking up nearly half of the screen, but it doesn't include all the CIB's extra features, having just hold, nudge and gamble. Some of the fruits have numbers, and if enough of these appear on the win line you gain nudge or other features. I found the instructions misleading and in some cases wrong.

Las Vegas seems to give you the excitement of a game. It doesn't but if you want a fruit machine it would be worth getting.



Carry on laughing

by
Dave Ware
1978
Commodore 64

CARRY ON LAUGHING! I very nearly split my sides! But then perhaps I am getting just a bit too cynical in my old age although there is no hiding the fact that this is not exactly the

best piece of software to come from the Live Wire stable. Even so, however, I suppose, so no, on Christmas. Anping on with the review.

It comes as no surprise that you are in control of Mr Live Wire himself. He gets around a bit, does Mr Live Wire and so, now he is the cartoonist at the International an infamous school for dimensional computer programmers. Apparently he's getting into a bit of a fix trying to tidy up all the classrooms starting with the dining room and moving on through the biology room, the chemistry lab and brewing it all in the computer room. When it comes right down to it this is little more than a fairly basic platform and lets game with a number of objectives to achieve and obstacles to avoid.

With only three lives to reserve the going is fairly tough. But when the going is tough, the tough get going, and doubtless you will succeed in turning the classroom loosely down around the screen once more. There, I know I could have seen a positive here.

Cauldron

by
Miller Software
1978
Commodore 64

THE CASSETTE TAPES OF Cauldron will convince most people that this outing, in which you play a witch on her broomstick, should be added to their collection. The play's graphics are good and, just for a change, the screen graphics are, if anything, even better.

The game could have done with a few more instructions though the publishers obviously do not wish to give too much away in this scarce "adventure", with various

screens requiring a touch of trial and error to discover just what artefacts should be used. During the first few plays, a lot of the time was spent finding out how to get about far less than centre screen.

The joystick guides a witch about on her broomstick over a moorland landscape of forests, lakes, volcanoes and mysterious doors. Spells can be hurled at naughty ghosts and warlocks and other inhabitants of the netherworld. Collisions with these spells drain your magic but this can be replenished at the local magic shops something reminiscent of quickies. Various doors become apparent as you pass over with the witch on her quest through this Halloween landscape and the object, as far

as I could determine to land on the ground is difficult task in itself, and collect keys with which to unlock the doors to subterranean lairs whereon magic, jewels and other horrors could be found to increase the witch's power. Cauldron is, superficially an original game but on the few occasions when I did succeed in reaching the centres of moorland lairs behind these locked doors there was more than a hint of platformer in the air.

Despite the lack of instructions the game is well produced and a mix of the "play once and derive it" variety, sounds very good but nothing special, few items as far as could be ascertained are achieved were not catered for but graphically the game takes full advantage of the 64.

111

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Major Blink

★★★★
C64
16.95
CIB

THIS GAME USES A PAINTER TOOL scenario – you must guide Major Bink about a maze of passages parking the area between the paths by moving around the area. At each area is painted,

you gain points. Inevitably, he isn't that simple and two sets of mines try to get you. Finally, colour blind bees move down the screen reversing the painted areas. You can shoot these bees but, of course, they keep coming. Secondly, the maze is inhabited by roaming snakes which endeavour to catch the Major but which can be temporarily disabled by shooting them. The top portion of the screen is a safe zone and no bees will appear while you're in this area. Clear the

screen and move on to the next.

The game makes full use of the C64's colour capabilities and is bright and a bit pretty. The design and animation of the figures are neat and effective. Both keyboard and joystick options are available but, for success, a joystick is necessary. The game is both testing, addictive and great fun to play. It uses all the memory limitations of the machine, it's a bit of an affliction game and worth a try. **A.M.**

Software Spotlight

3D-Scramble

★★★★
Atari 2600
16.95
CIB or CIB (Joystick)

HANDS UP ALL THOSE WHO WANT another version of Scramble. Come on there must be someone. What if I said it was an magnificent 3D perspective? That's slightly better – you're in luck because Immersion Software has just released 3D-Scramble for the 64.

3D-Scramble is, as a refresh of the old arcade favourite, an all new and lively, has you flying through the same old caverns, a city flying past and a constant fireball. At your defence are the manipulative beams and to stay in the air you must bomb the enemy fuel tanks.

On powering up you are given the option of one or two player mode, you can select any one of ten skill levels and play from either keyboard or joystick – advice the latter, it's far easier. 3D graphics take a little getting used to, to me this looked lumpy and pretty crude, but the figure bomber you control is quite chunky and responds not slowly to the joystick for my liking. In it's heaven, there



is good use of colour, but the really outstanding feature of this rather ordinary game is the music. A really stirring rendition of 801 Squadron plays throughout (but can be turned off) if only the game was of the same standard as the music, all would be well.

Overall the game was a bit of a let-down. There are variants of Scramble available, often not in 3D, which play better. Not even the soundtrack can get this offing more than two stars – the music deserves a better game.

M.T.L.

Club on a Limb

★★★★
Amiga
26.95
CIB or Play4 Joystick optional

SO JACK TWAPPED HIS MOTHER'S COW for a bean pod and, for him being grateful, she threw it from the window in a temper!

The game starts with Jack leaping from branch to branch to climb the beanstalk, after which he hops through the clouds and enters the giant's castle. It all sounds very simple, but the beanstalk, the clouds and the castle are riddled with word problems, whose reach is invariably fatal. These come in many guises, including magic disks, killer jello-beans and Devil's Hoovers, and these are not easy to avoid. Once in the castle there are 11 rooms to explore, with the eventual aim of finding treasures, a golden egg, a harp and a bag of gold.

Basically this is a platform game, but it scores for its size and sharp quality. On completing one section of the game, the next loads – there are three parts in all, so playing well over 100. No score is kept as the aim is to get as far as possible in the shortest time – the time elapsed is displayed throughout. The graphics are primitive, though inclined to flicker, and the sound effects are good.

A very interesting, challenging game – highly recommended!

...

Give my regards to Broad Street

 Adept Press Software Group
 £7.95
 C64, M and Jovaris

HAVE YOU EVER BLANKETED FOR A TAXI driver in central London? It is a good view, bridge of the river's transport system, together with a photographic history and some experience of human nature would be invaluable. Coincidentally there are also the attributes you need if you are to play Broad Street with any chance of success.



You take the part of Paul McCartney in search of a missing album track, pieces of which are in possession of various of your friends. Unfortunately it is Saturday and your friends are scattered all over London doing whatever they do at weekends, however being friends, you have a good idea of their interests and habits and as they travel exclusively on the underground you need only to be at the relevant station as they leave for them to give you their piece of the song.

To aid you, your car is equipped with a computer linked to the central transport system which informs you of their whereabouts. Using this information together with a road map of the area, you make an inspired guess as to their destination and tear across the city in pursuit - avoiding traffic warden and lenient drivers - accompanied by a scored rendering of Band on the Run. There are ten pieces of the song, all of which must be found between 1:00 am and midnight.

The program is a riveting variation on the maze-type game with good use of 16-bit graphics, tones and colour. I found it very demanding and highly enjoyable.



World Series Baseball

 Adept
 £7.95
 C64, M - 1 or 2 players

BEING A LOUIS CHAMBER BROOKLYN fan, I sat down enthusiastically to play the computer version of the American national sport. I soon discovered, though, that I am a player even Charlie Brown's team could beat.

Graphically this game is superb! You are presented with a picture of a baseball stadium as seen from behind home base complete with cheering fans and a crowd of spectators. A large screen at the back gives information and a close-up of the

action. All control is by joystick, with the joystick serving a variety of functions at different times. The controls are not too difficult once you get the hang of it. All the features of the real game are included, even down to a troupe of cheerleaders who appear between innings!

I found the game excellent for two players, but control is so complicated that playing against the computer feels inevitably to humiliate defeat. There are other criticisms too - the ball is very difficult to hit, and the pitcher who responds is not always the one you might expect.

On the whole, however, it is well programmed and I can recommend it, provided you can find two people and a human opponent!

A bumper book section, this month, includes a look at one of the C16 books hitting the market.

Title:
The Commodore C16/Plus 4
Companion
Author:
Brian Lloyd
Publisher:
Sunshine Books
Price:
\$5.95

COMMODORE'S LONG-ESTABLISHED reputation for producing poor documentation lives on, long after the quality has been substantially improved. Thus, many books have been produced with the advent of new machines. The C16 and Plus/4 offer two major advantages to the publisher and author. Firstly the operating systems are identical on the two machines, except for memory size and, in the case of the Plus/4, the built-in software. Secondly, there is a potentially large market, on the one hand for the absolute beginner, and on the other hand, for the businessman or businesswoman who wishes to start to make effective use of the machine.

The author has totally ignored the Plus/4's built-in software, which is an amazing omission, even for a book containing only 160 pages.

Knowing that the author is highly knowledgeable about the Dragon computer, we become curious as to whether he knows as much as he should about Commodore machines. Regrettably it appears not.

For a start, I am not impressed with an approach which includes BASIC, DATA, and RESTORE commands under the heading "More Advanced Programming". They are amongst the easiest commands to understand, and are frequently the group with which beginners become accustomed, as soon as they have overcome the excitement of getting out their name on the screen.

Similarly, the use of the word "lost a reel" in the context of HIGH-DISK/40 is likely to cause confusion amongst Commodore users. To such users this expression has always meant reading the Directory and Block Allocation Map into the RAM of the disc drive. To have the meaning suddenly changed to cover the destruction of the contents of the disc is dangerous.

The comment on the back cover suggests that after reading the book, you

REFERENCE



should be proficient in the more sophisticated programming techniques such as disc file handling. This overstates the case. Any disc drive likely to be used with this machine will have a drive format. It is available for random access; there is no mention of this in the book.

The Chapter called "Structuring your Programs" contains no discussion on how to do that. It contains some information about commands: creating program structures such as loops, but DO WHILE and DO UNTIL are not covered, whereas FOR NEXT is. The section in this chapter on LOADING and SAVING programs belongs elsewhere.

The Machine code chapter is only a run through the commands included in the built-in MONITOR.

The chapter on peripherals goes dangerously over-nature of some importance. The use of the COLLECT command to deal with improperly closed files is covered, but you are not told how to identify such files for the action appearing on the directory. Similarly, it is suggested that the COPY and BACKUP commands are useful if you have more than one disc drive. This is true enough, but only if those two drives are accommodated in a single disc unit. The discussion is important, and is made more in Commodore's own documentation.

Having thought this book is written in a most clumsy style than Commodore's own documentation, and is therefore considerably easier to understand. However, you would be better advised to wait for books written by more experienced Commodore hands, like Raine West and Peter Cottrell.

Title:
Commodore 64 Basics—A self-teaching guide.

Author:
Ann Harris
Publisher:
Wiley Press
Price:
\$15.95

IF'S ALL VERY NICE ANSWERING THE call to join the high-tech generation and buy a computer, but it's rather difficult to learn to program a computer well if you have absolutely no previous experience. Once you've learnt a language, it's a great deal to learn a new language or move onto a new machine. It's for those reasons that I enjoy reading good quality teaching books, such as this one, which achieve what they claim.

In my experience as a teacher, this book reinforces the information given by providing practical questions for the student to answer. This isn't really my cup of tea, but it does work.

The book sets out to teach you the use of BASIC and give a feel for graphics, sound and disc handling. The approach to the problem is to tackle the material in small pieces. The preliminary section deals with the hardware and how to connect it. The owners of this drive the commands are described in a simple manner. To get you going, sample one-line programs are introduced along with tips to save and load your programs. The philosophy is simply to help you gain confidence by using the computer. Once

LIBRARY



you realise that you cannot hunt the markets, it's surprising how easy it is to win.

Making progress beyond this point takes some work, as the concepts of flowcharts and algorithms and required subprograms in the book use flowcharts, concerning their work, and the most advanced concepts such as decisions and looping are illustrated with examples of their use and value. The section on programming is completed with a listing for a simple database program using sequential files. This is that is probably a good idea for the 'first' where data drives are common, it isn't for the UK. This aside, it is a useful example of how to write such a program. The remainder of the book discusses simple graphics, queries and sound. While these subjects aren't covered in great depth, it's a nice available option.

On the whole this is a detailed and dependable book which teaches the subject of programming in a simple but effective manner.

Title:
Introducing your Commodore 64
Author:
P. K. MacInnis
Publisher:
Longman
Price: £3.95

SEVEN PACKED PROGRAMS, NEW Programming Skills is such in the heart on the cover of this book, from which you

might assume that here we have a new approach to BASIC, in actual fact the book is full of everything that has been published of late, while the approach is directed towards those of limited intelligence. A lot of space is filled with cartoons, flashy images and waste comments.

Quote: How do you make text work a bit step by step and write it all down. This is your the making program. Unquote. Get the message!

The contents of the book cover a variety of subjects including the available user defined graphics, queries and sound, the AT&T BASIC section is rather retarded; not the top of the fourth!

The last that can be said is that all the programs are functional.

£24.

Title:
The Complete Commodore 64
Author:
Dennis Jarett
Publisher:
Hutchinson Computer Publishing Company Limited,
Price:
£7.95

THE CLAIM FOR THIS BOOK IS THAT it could be the only 64 book you'll ever need. I doubt it; this is true but as an overview of the Commodore 64 system it is undoubtedly an excellent reference manual.

The book is presented in a lively

manner with each chapter divided into sub sections, thus making it not only a good, easy read but also a sensible candidate for browsing through in idle moments.

It opens with a brief-headed overview of the 64 which, though obviously favourable, does not ignore its weaknesses such as rudimentary BASIC and non-standard BASIC. This is followed by a pointed history of Commodore computers prior to the introduction of the 64 and has an excellent section on Commodore's licensing policy, after the 64 up to the introduction of the Plus/4 and C-16.

At this point the book launches into a clear, concise description of how to set up the machine, finding your way around the keyboard and making the first steps in programming. The last section includes lots of short routines to demonstrate the use of the BASIC reserved words within a program structure.

The sound and graphics functions appear in later part of the section but the explanations here more of the programs of the earlier sections dealing with the relatively easier commands.

The third major section deals with peripherals, after general introduction to filing systems. Cassette recorders, disc drives, and printers are all dealt with in a fair amount of detail, giving a far clearer understanding of each one than you get from their individual manuals.

Unfortunately, there is a serious omission in this section. The 1540 plotter/printer is dealt with very cursorily and the text inadequately implies that the same commands can be used as for the Commodore dot matrix printers, simply by using the device number 1540 instead. This not only underestimates the capabilities of the 1540 but is also incorrect in most cases.

The section on business applications takes a long look at the types of software available with regard above on choosing the correct package for your own requirements.

A brief look at the facilities of the 1540 portable closes the section and leads on to a miscellany of error messages, some useful memory dumps, a glossary and bibliography, finally ending with a summary of the available BASIC keywords and a useful memory map.

The Complete Commodore 64 is definitely a must for the relative newcomer to the machine but offers little more for the experienced user and if, as the cover claims, it could be the only 64 book you'll ever need then why bother with a bibliography. The bibliography is already a mere twenty pages at the kind of publication available for the 64 - after all, in the section on magazines, a glaring omission is that most successful magazine for 64 owners: *Your Commodore*!

Get more from your Commodore 64

The Commodore 64 Kernel and Hardware Revealed

Nick Hamphill

A knowledge of the Commodore 64 kernel software and the hardware with which it interacts is essential for all programmers wishing to make full use of the machine's capabilities. A thorough knowledge of the kernel software will give the programmer a wealth of ideas and methods for solving programming techniques.

Now by Nick Hamphill

The Commodore 64
Kernel Revealed
50 pages
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**Be-whic, Dave Crip, casts his
ready eye over the best of
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BUSINESS BONANZA

The Silicon word

WORD PROCESSING IS PROBABLY THE most common business application for the home computer. At some time, most people want to prepare a well designed and clear letter. The word processor allows you to do this with ease. It also enables you to amend errors before printing the finished letter.

To see or not to see

There are two basic types of word processing: pre-formatted and post-formatted. A pre-formatted word processor shows the document on the screen as it will be printed (with a few exceptions) while, with the post-formatted type, the document does not appear as it will be printed but has certain characters which indicate what will happen to the text. Most post-formatted word processors have a preview facility which allows you to see what the letter will really look like when printed.

Top of the form

Typewise, to me, is almost perfect. It only lacks an 80 column screen (a feature of the 64, of course) if it did to me and all of the important functions such as word wrap, mail merge, justification, decimal tab and so on are there. All the keystrokes to format and to do are logical and easy to remember, except for mail merge and file transportation: a manual is almost compulsory. Some of the most impressive features are:

- the facility to input a new format text at any time throughout the document. For example, you can insert new tab stops if the style of the letter changes.
- the delete text function. If you press the Commodore key and delete key and move the cursor over the text to be deleted, the text changes to white. To insert text you then press the Commodore key and insert, and the following text shifts down. You can now type an unlimited amount of text between existing text.

Printout

It is vital to receive hardcopy of what you see on the screen, although some packages tend to overlook this. Typewise includes all sorts of built-in interfaces

which should make it compatible with most printers.

It employs a very effective method to make the most of your printer's extra functions. If your printer can add codes to produce such things as underlines,

Typewise with 80 column screen		File	05/14/84/700
Screenplay			
C. program			
Screen			
Word 1/2			
Wordwise	disk	175.00	
Wordwise	diskette	185.00	
Wordspell	disk	155.00	
Wordspell, word	disk	175.00	

Commodore with 80 column screen		File	05/14/84/200/5
1. Screen 1/2			
Wordwise			
Screen			
Screenplay, Word 1/2			
Screenplay	disk	175.00	
Screenplay	disk	175.00	

Typewise 1/2 screen		File	05/14/84/200/5
Screenplay			
Screenplay	disk	175.00	
Screenplay	diskette	185.00	

Wordwise 1/2 screen		File	05/14/84/200/5
Screenplay			
Screenplay	disk	175.00	
Screenplay	diskette	185.00	





script, or superscript, it is possible to specify the escape code and then to 'THANK' that particular function by designating the code as the Commodore key + a number. This is the only word processor I have seen with this specification.

40 column solved

Viz software have overcome the problem of a 40 column display very effectively. It is possible to edit text as normal in which case the whole screen scrolls to the left as text is entered (which I find off-putting) or preserve Commodore style and W (for width), the text is then re-formatted to 40 columns. Thus, you can see everything you type at all times without the off-putting scroll. If you press the Commodore key and W again, the text is instantly returned to the original width. A post-formatted word processor is alright when churning out blocks of text but I find them hard to use when presentation is important. No doubt, many people will disagree!

words and can learn many more. If you have specialist needs, the dictionary can be edited.

Legally binding

Vizawrite is probably the most expensive of the most popular word processors, but you get what you pay for.

It is equally capable of both home and business use and I know it is their only word processor. With their specialised pages, the spelling checker is vital and the time it saves has paid for Vizawrite many times over.

I feel that, if you are going to buy a word processor for the long term, or wish to change your present system, you can't fail with Vizawrite. It's part of my electronic office.

Black marks

One oddity present on Vizawrite is the way in which it uses a macro fill step instead of a space. This is an odd quirk which appears to have no particular function. The macro fill step is too thin to get confused with an ordinary full stop but I am at a loss as to why it is there.

My other mean is the start-up colour on the screen. The first thing I do when starting a document is to change the colour combination to black screen and border with green text.



Spellbound

Vizspell is a spelling checker which is loaded from within Vizawrite. Once the spell check is over, the program returns to Vizawrite with two kilograms. There is a built-in dictionary which contains 38000



Electron spreadsheets

Electronic spreadsheets are possibly one of the most under-appreciated pieces of business software on home computers. In many cases, the spreadsheet is used as a glorified desktop calculator. But, with time and practice, a spreadsheet can be a most valuable tool where any type of numeric manipulation and forecasting is required.

Going by the book

A very handy book is *It will not only work out formulae for saving spreadsheets but also has methods for daily flow projection, job costing, work analysis and so on which can be converted to work on most good spreadsheets*

Cartridge disc and turbo

Vision is available in 2 of 3 versions - both are on cartridge (4K or 16K) which also require a disc.

The screen display reminds me of the Microstudy screen. It is not as professional with smooth and simple movement around the screen.

Visucalc is more conventional. One plus is its very impressive turbo-load system.

Spill for choice

In my experience selling, I find it hard to choose between Visucalc and Visucalc.

Visucalc is purely a spreadsheet whereas Visucalc is also a programmable database. But, both are excellent pieces of software which dispense just how good a tool the Commodore 64 can be as a business environment. Both work fast - global calculations are noticeably faster than on most of the other spreadsheets listed below.

On the menu side, the manuals are helpful but do not constitute the imagination. Visucalc also contains an excellent demo program which points out some possible problems if the user's site dry.

Setting a standard

Spreadsheets are one of the few programs where a degree of standardization is present. However, experience, if you have a particular need, you need to get the same menu of choices. This does mean that if you are in a business where you are using a spreadsheet in a business environment as your main, it would be possible for you to have a similar arrangement on your 64 at home. For development and experimentation purposes, there is a tremendous help. I am

aware of one instance where a complete cash-flow forecasting model was set up on a 64 and then transferred to spreadsheet on a 64. All the development was done by one man at home.

It is hard to do a spreadsheet where it is a demonstration in a retail outlet. A good demonstration takes time, and in an average chain store, the reader probably won't have much more than you. Try to find somebody who already owns one, and ask them to let you experiment.

Other offerings

Neither Visucalc or Visucalc are cheap but both are well worth the money.

The spreadsheets mentioned before are other goodies. But, beware, there are some spreadsheets lurking around that are so bad that they are hardly worth the disc they are stored on. So, look before you leap!



Visucalc
see above for address
Visucalc

disc cartridge £19.95 for 4.4

Support
BMC Sales House
Canning Road
Shepperton
Middlesex UB8 3PH
Visucalc

Te: 04-951 1166

disc £19.95

Visucalc
see above for address
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see above for address
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Money-go-round

Sales ledgers, purchase ledgers, cash books and nominal ledgers deserve a business supplement in themselves. There are several available and the trouble is one such that it is difficult to recommend one in particular.

Incapacitated

Most businesses have the same basic needs as far as ledgers are concerned although the methods used may differ greatly.

One problematical people have when they have been running programs like these for a while is the sudden realisation that they do not have sufficient account capacity. Before buying, make sure that you know how many accounts you have, approximately how many invoices the ledger amount may have and so on, because that the person selling you the package understands your requirements.

Field testing

A problem with reviewing this type of package is field testing. It is possible to enter sets of dummy data and test that everything looks OK but, when a program is being used fully and regularly, things can be quite different. I want, therefore, to point out that my observations are based either on dummy data or a few weeks' use by one true user.

My use has been on three points in the use of software from Anagran.

Essentially, this is a cashbook, sales ledger and purchase ledger. There are other modules such as stock control but these are not relevant in this context.

Anagran's software has been available for a wide range of Commodore, but a long time ago the format they have found has been well tried and tested. They are in easy to use as ledger can be and are professional packages.

The question of integration

There is no integration but three total integration of modules would be expecting too much of the 64. However, the structuring of the programs is so good that little 'hand work' is required.

The manuals are clear and concise but, if you don't know how to run a ledger, it may be worthwhile investing in a book such as *Business Made Simple*.

The sales ledger has a prompt in order to prompt you, these can be found for most parts of the program where you may encounter problems. It is worth getting a pair of the best ledger and

posting in the relevant accounts done as a separate option. Cash sales are entered into a separate cash account.

The capacity of the software depends on the amount of information that you store on each account. But, Anagran say that it will handle 328 accounts where there is a maximum of 10 invoices per account or 128 accounts where there is a maximum of 75 invoices per account.

Anagran's sales ledger is very comprehensive and would not be out of place in any small business.

Purchase ledger

The includes nominal analysis and is in the same format as the sales ledger, so ease of use is guaranteed. Capacity again depends on how many transactions per customer are needed but, as a guide, Anagran say 128 regular accounts and 50 nominal accounts with a outstanding invoices per account of 75 support

accounts with 50 nominal accounts and 75 outstanding invoices per account.

Cashing in

The cash book is the easiest to get to grips with and may be quite enough for business where most of sale is done in cash and earned purely running a sales and purchase ledger. Its capacity is 50 analyses headings with approximately 2000 postings of 100 analyses headings with 2000 postings. Once again, reports are complete and very well laid out.

Extra, extra

Company Pack 124 from Impact is very good. Bookkeeping for the Cash Trader from Quick-Count is also very good as are the others mentioned before. I have mentioned a number of packages that I found unreliable or too hard to use.

<p>Anagran Systems Sales Ledger Cash Ledger Purchase Ledger Cash Book</p>	<p>12- 08 1984</p> <p>£75.00 inc V.A.T. £75.00 inc V.A.T. £75.00 inc V.A.T.</p>
<p>Buy as follows: Nominal ledger Company Pack Stock Control Nominal ledger Cash Book</p>	<p>12- 01 1984 0000</p> <p>£101.75 inc V.A.T.</p>
<p>Quick-Count 15 Anal. Cash book Company Pack 124 Bookkeeping for the Cash Trader</p>	<p>£89.50</p>
<p>Impact Systems J11, Impact Anagran Kym, Impact Landscape</p>	<p>12- 07 1984 0000</p> <p>£87.50</p>

The printed word

Choosing a printer for your Commodore computer can be difficult. Due to the printer port, some type of interface will be needed in order to connect a non-Commodore printer.

The Commodore MP4000 is the budget printer in the Commodore range but its facilities are rather limited, and the other printers in the range are not particularly easy to choose.

The answer is to buy another make and the relevant interface. The most popular non-Commodore dot-matrix printer appears to be an Epson compatible Cytronetics type. These usually offer more facilities not available on the MP4000. Those choosing daisy-wheel printers are also going for the electronics type.

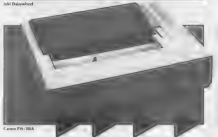
There are a wide range of interfaces to drive a printer. These can either be software based or, what I call, hardware. The software based interfaces consist of a lead and drive software. The disadvantage with this arrangement is that you may find that the drive software conflicts, in memory, with the program with which you wish to use the printer. There are no such problems with hardware. My particular favourite is the Turboprint II which was reviewed in the December issue of *Home Computing*.

Canon PW-500A

This is a near letter quality dot matrix printer. It is a little on the large side, weighing a hefty 10.5 pounds in a hefty 1900ps in ordinary mode and 250ps in near letter quality mode. I have seen better dot-matrix printers but overall, the print quality is very good, and for me a lot better than the Epson. It supports enlarged type, condensed, wide, proportional, 8/9 dot graphics and, with a good interface, these options are easy to select. Paper loading is easy except that, if you have pre-folded paper and the lever is set at inches, the paper folds up. There is a 25 printer buffer which is useful on small printers. The price is a bit higher to ensure the computer fairly quickly.



Juki Dailywheel



Canon PW-500A

Overall I found this fast, very quiet, and reliable and I would imagine it would be long lasting even with high usage.

MP-100

The Micro Personalist MP-100 was another dot-matrix printer, its specifications were fairly close to the Canon, even down to Serial 2500/1000ps switches. This would probably be a better buy than a Canon. Not only is it cheaper but it is so close to Epson PS ribbons which are usually available at most computer accessory shops - some Canon ribbons are cheap!

great problems in obtaining it is not as quiet as the Canon but the level was acceptable. It's dot-matrix quality line on the way very good, with the bonus that it could be turned on part way through text pages. With a little practice I found I could highlight paragraphs by pressing the 'line' switch at the start of the paragraph and pressing it again at the end.

Like the Canon, this appeared to be a workhorse.

The JUKI Dailywheel

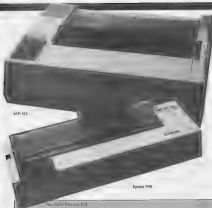
This daisy-wheel printer is for those of you who are prepared to sacrifice speed for high quality printing. The Juki is to

slow is fact that I found I could type faster than it could print! Unusual but a great ego booster.

The Juki does have the advantage of being a typewriter as well but I won't imagine this would be the choice of the irregular, low volume user.

It has some nice touches such as delete mode - you can get rid of a mistake, all the old character, and overtype with the correct character. It also supported decimal tabs and centring of text, but the quality left a lot to be desired and it did look like a budget machine.

The ribbon only lasted a few



Epson P40

days, and my attempts to obtain a new ribbon proved futile and so it sits here unused and unused!

The Epson

This is, perhaps, different to the other three printers mentioned here. It is a dot matrix printer with what I would call fairly standard Epson specifications, i.e., enlarged, condensed, emphasized, double strike, underline, italics and graphic modes. However, here is the difference: 285 mm wide \times 51 mm (H) \times 160 mm (D).

For those of you (like me) that were born before 1940 that could be about as big as a London bus. In fact it is about 11 inches wide it has a deep and 23 inches high.

Small, yes, but packed full of fun. It will print on ordinary paper or heat sensitive paper. It is a laptop terminal, if you have a portable, it is there on a 600 baud battery powered.

A full 80 column print-out might make you think that the end result was printed out on one of its bigger brothers, and for only £140 (approx) it's on the cheap side but it is not particularly fast (approx 10 cps) but for the convenience of a thin printer, its speed is worth estimating.

The print quality is very good. There is a variable density setting so you should get a reasonable printout on most paper although smooth is recommended. The type face is very attractively Epson but that is not a bad thing.

For somebody who finds space a problem this may well be the answer, here all you need is to get the 1400 running on an Ever Ready R99.

Summing up

This has been a very brief look at just four of the wide range of printers that can be hooked up to the 64. Before you buy a printer, check the ribbon first on it the 64 format the printer will still work, if the type spins, the printer will still work, but if you cannot get a spare ribbon you are stuck.

MacKinnon Murray Ltd
MacKinnon House
MacKinnon Road
Reading
Berks. RG2 0LT
Tulipoint/CEI

Tel. 0734 711281

£225

Carroll UK Ltd
Carroll House
2 Marlow Road
Mullingham
Surrey GU10 0BA
Carroll PW-800a

Tel. 01-275 1074

£140

Atkins Phipps & Ltd,
Unit 3, Lane 3
Harrowby Wood
Wade Road
Basingstoke
Hants RG24 0NA
AP/140

Tel. 0745 471071

£200

Eric (Europe) J. CMAH
c/o Ashby Instruments Ltd
28 Bland St
Harrow
Herts HA8 3AL
EJC/220

Tel. 0209 443070

£245

Epson UK
Oakland House
180 High Road
Wembley
Middlesex HA9 6UH
Epson P-40

01-902 6460

£160

GLD
5000

become the new 'alpha' character set and are accessed by using the shift key with the usual character key. This means that long strings or print statements may be easily entered by using the 'shift lock' key.

J) Pressing "run stop" and "restart" will reset the standard character set.

d) Many other user-defined graphics routines consume a lot of memory, but this program only uses 179 bytes leaving an ample 17,366 bytes free in which to name your programs.

ii) The new characters are held in locations 12672 to 12699 and 12698 to 12715.

[illegible]

100



Take advantage of a very
special offer and dazzle your
friends with your amazing
artistic ability.

CHARACTER DESIGNER

CONGRATULATIONS! YOU'VE WON the chance to add truly professional graphics to your programs. Now, we're not going to provide our readers with their very own Tony-Crawford clones but we believe we can offer the next best alternative - a character designer used by a major software house to create its own feature-length games.

Your Commodore, in conjunction with Home Computing Monthly, are offering Virgin Games' **Character Designer** at a price we're sure any of our readers can afford. For **£99**, plus a few hours spent studying the documentation on the following pages, you could soon be producing (or maybe even surpassing) the works of art screaming from the screens of games such as *Palmer Patrol II*, *Swords* and Virgin's latest *Artistic Adventure*, *Gates of Doom*.

But that's not all. With your **Character Designer**, you will receive a computer coupon which will allow you to enter the Year Commodore/Home Computing Monthly "Design a screen" competition.

Once you've got to grips with your **Character Designer**, use it to design a screen. Send your work of art to Virgin Games before the closing date of July 31st, 1985. The winner will be the reader who, in the eyes of our panel of judges has produced the most professional and artistic screen with the assistance of their **Character Designer**. The panel of judges consists of Jeremy Cooper of Virgin Games and the editors of *Your Commodore* and *Home Computing Monthly*.

And, the prize! The first prize is a day at Virgin Games and the thrill of seeing your graphics used in a Virgin game. The 40 runners up will each receive a copy of Virgin's *Gates of Doom* (you could any ongoing programme) as well as such an offer!

Don't delay! Fill in the coupon below and send it with your cheque for **£99** made payable to Virgin Games, to Virgin Games Ltd.

3-4 VERNON TARD LONDON W11

THIS INTRINSICALLY POWERFUL PIECE OF professional software allows you to add up to four individual character sets containing 256 characters each - a total of 1024 characters - in memory simultaneously. The use of raster interrupt techniques enables the entire character set to be rendered without affecting the main screen display.

With most character designers if you redefine your characters to look like, say, space invaders the invaders' prompts will turn to space invaders too! Not so with **Character Designer**!

screen or to design a screen for use in a BASIC or machine code program.

Loading

To load type LOAD "1" ;

To run type RUN ;

The program requires a joystick plugged into port 2.

If the computer has just been switched on or you haven't loaded a character set the bottom of the screen will contain garbage, both in the character set and



General Demo

Although designed for the professional user **Character Designer** is extremely user-friendly and suitable for anyone whose willing to spend a little time reading the documentation to familiarise themselves with the scope of commands. All commands are entered with a single uppercase, or via the joystick, and a help screen is available displaying the options.

The program is written in 100% machine code and occupies only 5K of memory including the HALP screen. It also includes a screen designer enabling you to set the character in combination with

and in the space above, the on lines above the set are all spaces (character 32). You can save yourself of the thought time by redefining character 32 to be totally devoid of "on" pixels and thus a genuine empty space. Alternatively you could copy one of the Commodore sets, or load a previously saved set.

If at any time you return to BASIC by typing RUN-STOP and BREAK, the program can be restarted without loss of data using SYS 96384.

If you wish to have a small BASIC program in memory at the same time as **Character Designer**, after loading **Character Designer** type POKE 12,15 POKE 96,0 MEM to lower the top of memory to 96K then load your program and enter SYS 96384.

Character sets

On the Commodore 64 all graphics are handled by the dedicated VIC II chip. One drawback of this chip is that it can only look at 16K of memory at a time. This 16K needs to contain all of the data for the

Name
Address
.....Postcode

Please send me **Character Designer** at **£99** each.

to: VIRGIN GAMES LTD, 3-4 VERNON TARD, LONDON W11.



character sets), screen and screen data (see Memory Map).

If a screen is shown in 1-bit mode, 96 of memory is used in total out of the 16K available, which is why most commercial programs tend to use a character mode, but instead of being letters these are replaced to make up a small part of the picture and are then placed together on the screen.

To define such characters without the aid of a device such as Character Designer involves sketching your design on graph paper, testing your binary arithmetic, connecting the sketch to a table, typing in and testing lots of data statements and then finally running a BASIC program to POKE the characters into memory.

Character Designer allows you to use the TV screen as monitor instead of graph paper, then it does all of the calculations and POKEing to memory. The data is saved to tape or disc as a block of memory which can be loaded from within a BASIC program or as part of a machine code program eliminating the time-consuming use of DATA statements.

Character Designer enables you to work on 256 characters in memory at the same time. These are divided into four sets of 64 characters, each occupying 4K of memory. Your program can use any of these sets instead of the Commodore set and even switch between sets during a program with a simple POKE (see Switching Character Sets).

You could redefine the alphabet to give you, say, gothic script or make or even a futuristic character set for use in your latest space epic. Or maybe by defining blocks of characters as stars, trees etc, you can create amazing backgrounds over which spaces can be built, or whatever it is sprites can do! At the risk of sounding clichéd, the only limit is your imagination!



Colour table

One method often used in commercial software to save time and memory and help simplify programming in multi-screen games is to allocate a colour to each character. This method is used by Character Designer.

The character designer section allows you to set the colour of each character. The colour is stored in a 256-byte table one byte for each character in the set and is primarily used by the screen designer when printing a character.

As with the character set the colour table can be saved to tape or disc and called upon for use in your own program.

Memory map

The diagram below shows how Character Designer is located in RAM along with the character sets, colour table etc. (See also Programmer's Reference Guide, pp 164-182).

How Character Designer is located in RAM			
Set 1, Set 2	One 64K character	16K	24K
Set 3, Set 4	Colour table	16K	24K
Program loads here (16K)	Program	16K	24K
Screen table (character sets, images)	Set 1	16K	24K
	Set 2	16K	24K
	Set 3	16K	24K
	Set 4	16K	24K
Commodore character set, a BASIC image not deleted	Set 1	16K	24K
	Set 2	16K	24K
	Set 3	16K	24K
	Set 4	16K	24K
	Cursor	16K	24K

Using the Character Designer Screen layout

1. Grid on which an 8x8 pixel character can be edited.
2. Character set, the current set of 256 characters.
3. Cursor indicating character being edited.
4. Character being edited, displayed along with its "POKE code".
5. Mode indicates current process should read (GET or SELECT).
6. Current set, numbered from 4 to 7.
7. Multi-colour indicator - reads ON or OFF. The colored figures show the selected multi-colour.

As mentioned in the section on loading Character Designer it runs by typing SYS4084. If the computer has just been switched on or you have loaded a character set the bottom of the screen will contain garbage, both in the character set itself and in the space above. The top lines above the set will contain "space" in character 32. When you run Character Designer the screen will appear full of unprintable garbage. Changing character 32 of any set points (making it a true empty space) will clear the top six lines and loading a Commodore character set or one of your own sets, make some out of the bottom lines.

Select mode

This is the most of the designer when first run, allowing you to move quickly to any character. Using the system in part 2 the character to be edited, indicated by the flashing cursor, can be selected from the current character set. The cursor can be moved in all four directions. When the five buttons or any key is pressed the designer goes into EDIT mode.

Edit mode

Once your chosen character has been selected and button or key pressed you will be in EDIT mode. As suggested by the

name, all editing commands are entered on the mode. The most important function is the ability to turn on or off individual dots on the grid, which correspond to pixels of the character. The purple filled circles indicate "on" pixels whilst the open hollow circles indicate "off" pixels. The white circle is the cursor, controlled by the joystick. Pressing the top button switches the pixel from off to on or vice versa. The actual character can be seen below the grid.

As well as being able to design the character directly, there are a large number of commands that can be input from the keyboard. These are described as follows.

Editing commands

The commands are all initiated with a single key press and are detailed in the order they appear on the HELP screen.

1 Left arrow and up arrow = Move
These keys move the character on the grid horizontally and vertically respectively. If there are no dots the cursor appears but the keys to the left of the "I" key and to the right of the "J" key.

2 H= invert

Inverts the character on the grid. I.e. all "on" pixels off or vice versa.

3 R = Rotate

Each press of "R" rotates the current character 90 degrees anticlockwise.

4 Cursor keys

These scroll the character on the grid one pixel in the appropriate direction with full wrap-around.

5 Shift/Ctrl

Clears the grid, making the current character a space.

6 Home

Returns the cursor to the top left of the grid.

7 C = Copy

The powerful command enables any character from any of the four sets to be copied to the current character. When "C" is pressed the mode changes to "COPY", the bottom screen stops flashing and the prompt "SHIFT" appears. If the "I" key is pressed the designer cycles through the four sets in decimal order (LOCATE). When the desired set is located, or if you wish to copy from the set on show, simply move the joystick or press the button. The prompt will change to "CHANG" and the cursor will start flashing. The character to be copied can now be chosen with the joystick as described later in the section dealing with SELECT MODE, i.e. as soon as the button is pressed that character and its colour will be copied to the current character.

8 X = exchange

This enables the current character to be swapped with another character from the same set. On pressing "X" the mode changes to "EXCHANGE", simply select the character with which to swap the

current character by moving the joystick until the cursor covers it and then press the button or any key.

9 Ctrl/V/C = Ctrl/L/C

Will copy the entire upper case character set into the current set. The mode will change to "CTRL L/C", if you do not wish to copy the set press "V" otherwise press any other key to complete the copy.

10 Ctrl/M/V = Ctrl/M/C

As above but will copy the lower case character set.

11 L = Location

This is used to choose which character set to add data four to seven. Pressing "L" moves you to the next set. If the current set is seven, the next will be four.

12 S = Select

This puts the designer into SELECT mode.

13 M = Next

Will advance to the next character. If the current character is 255, this will have no effect.

14 P = Previous

Will go back to the previous character. If the current character is 0 this will have no effect.

current row. This is then repeated for the remaining seven rows.

15 D = Data

Enter pairs eight pairs of data in decimal alongside the character. The list will disappear when any key is pressed.

17 F1 = Character colour

Advances the colour of the current character.

18 F2 = Multi-colour 1

Advances multi-colour 1.

19 F3 = Multi-colour 2

Advances multi-colour 2.

20 F4 = Background

Advances background colour.

21 Shift/7/16 = Border

Advances border to our.

22 M = Multi-colour ON/OFF

TURNS multi-colour mode on or off.

23 K = Colour all

Will change every character colour to the colour of the current set.

24 Shift/5 = Load

Loads a file from Cassette and Disk Operator.

25 Shift/6 = Save Set

Will save the current character set.



Screen shot of Character Designer

26 Shift/9 = Number

This allows you to input a character as eight decimal numbers. When Shift/9 is pressed the mode will change to "NUMBER" and a prompt "N" will appear by the top row of the grid. A decimal number (0-255) can be typed in followed by 8 (L/R/M). If a number greater than 255 is entered it will disappear leaving just the prompt. If there is no number following the prompt when RETURN is pressed it will have no effect on the

26 Shift/C = Save colour table

Will save to our table.

27 Shift/A = Save screen

Will save the designed screen.

28 H = Help

Will display the HELP screen.

29 Q = Quit

Will enter the Screen Designer.

Alt Where the instructions say "press any key" (e.g. to leave SELECT mode) if the key pressed is a valid editing command it will then be executed.

Cassette and disc operation

These are the system messages as they appear on-screen:

SAVE COLOURS Type of save or load
CASSETTE OR DISC Type of device you are using
FILE NAME (8 CH) Give name, yes, give your file

Enter

PRESS RECORD AND PLAY ON TAPE

OK

SAVING BRICKS

PRESS ANY KEY

When any load or save command is entered the screen will clear and the following will appear:

- The type of operation (LOAD, SAVE, CHARS, SAVE COLOURS or SAVE SCREEN).
- Select device - press C or D to select cassette or disc, followed by RETURN, to confirm your choice. Character Designer will remember the previous device used, so normally you will just need to press RETURN.
- A file name of up to 16 characters can be entered from the keyboard followed by RETURN. Delete may be used as normal but the cursor key and INSERT will not work. The only occasion on which a null file name can be used is during a cassette load.

When using a disc drive "DISC NAME" can be used for a save and replace - and blanks can be used for loading.

If using cassette the banner will change to light blue and the prompt "PRESS PLAY ON TAPE" or "PRESS RECORD & PLAY ON TAPE" will appear; the screen will then blank and your Commodore 64 will load or save in the normal manner.

- After the load or save is completed, pressing any key will return you to the designer in SELECT mode.

Screen designer

To enter the Screen Designer section of Character Designer press "Q" in EDIT or SELECT mode. If no screen has been designed or loaded you will see a screenful of garbage. Press SHIFT/CLEAR to clear the screen.

At the top left of the screen a white cursor will be visible; this can be moved around with the joystick. Pressing RIGHT will put the current character at the cursor position. The character can be changed either by returning to the character designer and SELECTing a different character, or by pressing "V" or "G" (see below).

NR Only characters from the same set may be used on screen at any one time. The set used by the Screen Designer will be that currently chosen in character designer mode.

Summary of screen designer commands

SHIFT/CLEAR Clear screen
HOME Home cursor
SPACE Put a space at cursor position
RIGHT BUTTON Put current character at cursor position with colour from colour table

G

T

Q

get new character - if G is pressed the character under the cursor becomes the current character. TOST inside the cursor sets them green and text can be entered from the keyboard. To exit TOST mode press RETURN. Note: Text mode assumes that the alphabet is in the normal Commodore upper case position, i.e. A-Z, J-M.

quit Screen Designer and return to Character Designer in SELECT mode.



On computer

D Display current character at cursor position. When "D" is released the character will disappear; change cursor colour from white to black or vice versa.

V select a new character, this will only work if the cursor is on the bottom eight lines. These bottom

eight lines will be replaced by the current character set. The cursor may be moved around as usual and pressing RIGHT will select the character under the cursor. No other commands will work while the character set is displayed. The set will turn off automatically when the cursor is moved out of the bottom eight lines and the bottom of your screen will reappear unharmed.

Hints and tips

This section is intended for the beginner but contains much information of use to the more advanced user.

Creating multi-colour graphics

In its normal horizontal colour mode the Commodore 64 can only display two colours in each character square, the background colour and the character colour. It is only possible to display four colours in one square at the cost of halving the horizontal resolution. Although this gives the graphics a slightly chunky look, much more colourful designs are possible.

Instead of a character being eight pixels wide, as in basic colour, a multi-colour character is only four pixels across, each pixel being twice the width of a basic pixel, the means that with Character Designer we are able to use two dots for each of the four horizontal pixels with the



Figure 1



Figure 2

colour chosen according to the chart below.

OFF OFF
OFF ON
ON OFF
ON ON

Background colour
Multi-colour one
Multi-colour two
Character on one

You will notice that the chart says that when both dials are "on" the double pixel will be displayed in the character colour. This is not quite true. If the character colour is between red and yellow the character can be displayed in hi-res. If the colour is between eight and ten it will be displayed in multi-colour with the character colour appearing as character colour minus eight. E.g. if the character colour is 18 (light red) and multi-colour is on, any double pixel with both dials "on" will appear as colour $10 = 18 - 8 = 10$ (red).

To demonstrate this by setting multi-colour one to light blue, multi-colour two to white and the character colour to red and switch on, load on ON. Then enter the following data into a spare character using TAB/ENTER:

01, 170, 0, 255, 00, 170, 0, 255

You should see a red character but Figure 1 shows that it is actually the colour red. Press F1 three more times and the characters should look like Figure 2.

You will notice that we are restricted to using the first eight colours (the ones pointed out on the keys) when using multi-colour, but if we wish to have the character actually appear in multi-colour we need to add light to the colour code. No such restriction applies to the multi-colour themselves where we can choose from all 16 colours. (See also Programmer's Reference Guide pp 175-178.)

Using graphics in your own programs

If you wish to use a character set you have designed in your own program you will need to use a program similar to the one that follows:

```
1 X = 0 : I = 1
2 IF X = 1 THEN LOAD "CHARS", I
3 RUN YOUR PROGRAM
```

When you run the program will firstly load the file called "CHARS", assuming of course that it is saved on tape after your program or you change tapes after your program has loaded. This will cause the 64 to continue running the program from the first time (when a LOAD from a tape program the 64 performs the equivalent of a GOTO plus lines retaining all variables.) After loading "CHARS" X will no longer be equal to one, so your program will run as normal. This will also work with several files as below:

```
1 X = X + 1
2 IF X = 1 THEN LOAD "CHARS", 1
3 IF X = 2 THEN LOAD "COLOURS", 1
4 IF X = 3 THEN LOAD "NAMES", 1
5 RUN YOUR PROGRAM
```

You will need the programs saved to tape in the following order:

1 Your program 2 "Chars" 3 "Colours" 4 "Names"

While developing a program you might like to have the files saved on separate tapes. In that case try putting some sort of prompt at the end:

```
1 X = X + 1 IF X = 4 THEN PRINT
```

"CHANCE! TAKE THEM PRESS ANYKEY!"
WAIT 100 : POKE 190

NB: WAIT 100,1 will stop the program until you press a key and the POKE will clear the keyboard buffer.

Switching character sets

To choose which character set to use POKE \$1073, X where X is one of the following values:

X	Set	Comments
25	2	Commodore Uppercase Code (see below)
27	3	Commodore Lower Case
24	4	
26	5	
28	6	
30	7	

Note that if you choose the screen frame is normal position (1024 = 300), the value of X will need to be changed accordingly. See also Programmer's Reference Guide pp. 163-164.

Turning multi-colour on and off

To turn multi-colour mode on (POKE \$1070, POK \$1070) OR 16

To turn multi-colour mode off (POKE \$1070, POK \$1070 AND 255

POKEing the screen

Putting to the screen using strings of colour characters is a rather tedious method and also suffers from a certain sluggishness. It is often better to POKE directly to the screen memory.

If we first assign the following variables:

$X = \text{column number (0 - 29)}$

$Y = \text{row number (0 - 24)}$

$SCREEN = 1624$ (this is the usual position but it can be altered)

$COLOUR = 16256$ (the start of colour memory)

the addresses to be POKE'd can be simply worked out with the following formulae:

$PI = 40 * Y + X$

$POKE SCREEN + PI, \text{(character number)}$

$POKE COLOUR + PI, \text{(colour code)}$

PI

$160X = 20 * Y + 15$

$150 PI = 40 * Y + X$

$150 POKE SCREEN + PI, I$

$150 POKE COLOUR + PI, J$

= I print a white "A" near the centre of the screen, providing that SCREEN and COLOUR have already been defined

Using the colour table

If in addition to defining SCREEN and COLOUR, we define another variable

CTAB = 27504

and use CHAB to hold the character number, the following subprogram will print a character using the colour table defined with Character Designer.

$100 PI = 40 * Y + X$

$150 POKE SCREEN + PI, CHAB$

$150 POKE COLOUR + PI, HEX (CTAB + CHAB)$

$100 NEXT Y$

Background and border colours

To get the colours of the background, border and the multi-colours:

Border	= POKE 15189,X
Background = POKE	= POKE 15075,X
Multi-colour 1	= POKE 15082,X
Multi-colour 2	= POKE 15083,X

where X represents one of the following colours:

0 Black	8 Orange
1 White	9 Brown
2 Red	10 Light red
3 Cyan	11 Dark grey
4 Purple	12 Medium grey
5 Green	13 Light green
6 Blue	14 Light blue
7 Yellow	15 Light grey

Downloading a screen

You may wish to use a screen you have designed using Character Designer in your own programs. To do this set up the background, border and multi-colours, choose the character set and turn multi-colour on or off as desired, then use one of the following subroutines to download the desired screen on to the real screen. You must have loaded the screen, character set and colour table beforehand.

```
BASIC
1000 SCREEN = 1624:COLOUR = 16256:CTAB = 27504
1010 S2 = 24076:REM
1020 GOTO 1030
1030 FOR I = 0 TO 1000
1040 CH = PI(S2+I)
1050 POKE SCREEN + I, CH
1060 POKE COLOUR + I, HEX (CTAB + CH)
1070 NEXT I
1080 RETURN
```

1000 FOR I = 0 TO 1000 READ A

Code LoadPOKEA:PRINT A:NEXT

1010 CH15, 165,276,161,76

165,61,76,76

1020 DATA 165,76,161,76,76,

6,11,76

1030 CH15, 161,161,161,76,

177,161,161,201

1040 DATA 170,160,6,94,165,

76,200,76

1050 DATA 161,76,161,161,230,

230,230,24,165

1060 DATA 214,100,161,200,

214,76

To download the screen type: 150 4000:PRINT

150 This program will overwrite any screen pointers.

Moving blocks of memory

There may be times when you wish to move a character set, screen or even a colour table to a different place in memory. The short program below will do this for you.

```
10 FOR I = 0 TO LL-1
20 POKE DD + I, HEX (SL + I)
30 NEXT I
```

where LL is number of bytes to be moved as follows:

Character Set	3048
Screen	1600
Colour table	256

DD = the address you want to move the block to

SL = the address you want to read from (see the Memory Map)

Sprites

If you wish to use sprites in your program, remember to leave room for your sprite data. (The space occupied by a character set can hold the data for 32 sprites) Note also that the space occupied by the 6004 image (bits two and three) can't be used for sprite data.

Banking the VIC chip

As mentioned earlier, the VIC II chip can only look at 16K of memory at a time. It usually uses the first 16K of memory. This can cause problems as any character set or sprites limit the amount of memory available to BASIC.

One way around this is to move the VIC chip to a different location. The only 16K that is completely free is that from 16448 to 16512.

This is done using the following commands:

$POKE 16076, PEEK (16476):GOTO$

$POKE 16076, PEEK (16076):AND 255:GOTO$

Now all of the character sets, sprite data, and screen locations will need to have 16448 added to their addresses. The program in the section Moving Blocks of Memory can be used to move the character sets. (See also Programmer's Reference Guide pp 107-112.)

The example sets

Included on the package are two example character sets. The first, ADVANT, SET is a "gater"-style alphabet together with some characters to make up a picture of the type in many graphic adventures. The loads into the designer at SET 5. The associated colour table and screen are called ADVANT CLR and ADVANT SCR respectively. For the set the lowercase mode needs to be on and the multi-colours should be light grey and magenta.

The second example, which loads at SET 6, is a double-sized alphabet that could be used in an educational program along with a picture of a monkey too. The files are called DDDDD SET, DDDDD CLR and DDDDD SCR. To see the picture properly, multi-colours mode has to be switched off. A rather challenging exercise might be to write a program to convert an ASCII string to these double-height characters and PRINT or POKE them to the screen.

Bibliography There are many, many books on the market about the Commodore 64, especially concerning graphics. There is only one which is absolutely essential and has been referred to throughout this manual: Commodore 64 Reference Guide, published by Commodore.



Allen Webb doodles with
Cheetah's sweet talker and
BAT.

Sweet Talker (\$49)

IN COMMON WITH MANY OTHER products of its type, the Sweet Talker speech synthesizer comes in the form of a cartridge. The bonus with this product is that it is connected to the user port. This means that the cartridge slot is left available (since the Sweet Talker does not interface with the operating system, it can be left in place most of the time; the audio output leaves via the audio/video connector).

The package uses the allophone approach to generating speech. This means that rather than having a fixed vocabulary of words, you are given the ability to create a huge range of sounds. This is achieved by splitting speech into 40 sounds or allophones. These are combined, rather like syllables, to create words. The system adopted by Cheetah, however, is somewhat fiddly. Each allophone must be converted to a numerical code and the code used by a machine code routine to create the sound. This means that you must perform the tedious task of converting words into allophones and then converting the allophones to data. I have seen better approaches to dealing with this problem.

The clarity of the speech generated by Sweet Talker is good but has a rather mechanical sound similar to that of Junior in *Animal Magic*. The absence of intonation somewhat hinders the believability of the system, but the quality is above average. The package comes with a demonstration on cassette.

Overall, this is a good product which is worthy of serious consideration.

CHEETAH SPEAKS OUT



Cheetah gets BATed!

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joystick ports. When you press a control on the transmitter, an infrared signal is sent to the receiver, this is converted into a form which the computer can interpret. The upshot of this is that you can sit in your easy chair and play space invaders on your computer at the other end of the room.

The transmitter is not so much a joystick as a pressure sensitive pad. A disc with eight magnets provides the usual joystick type movement. The magnets are provided to give a tactile reference point so that you know which bit you're pressing. A single pressure pad provides a fire option.

The first obvious impression you get when using the BAT is that it's tedious to use than a joystick. I found it difficult to press a key and then subsequently, this was particularly crucial on games such as *Impossible Mission* which require precision. It would be a lot of practice to get used to the BAT, but many may find it daunting. Couple this aspect with its high price and you have a product which may have a limited market. This aside, it is a very well-made product which functions faultlessly.



A sweet-talking bat



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These results suggest that the use of the proposed model is not limited to the analysis of the data from the first two studies. The model can be used to analyze data from other studies as well. The model can be used to analyze data from other studies as well. The model can be used to analyze data from other studies as well.

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1. The first step is to identify the problem. This involves understanding the symptoms and the context in which they are occurring.



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1. **Introduction**
 2. **Background**
 3. **Methodology**
 4. **Results**
 5. **Conclusion**
 6. **References**

Abstract *Background:* The purpose of this study was to determine the prevalence of self-reported depression in a community sample of young adults. *Methods:* A cross-sectional study of 1,000 young adults (18–29 years old) was conducted. The prevalence of self-reported depression was determined using the Patient Health Questionnaire (PHQ-9). *Results:* The prevalence of self-reported depression was 11.1%. The prevalence of self-reported depression was significantly higher in females than in males (12.1% vs. 10.1%, $p = 0.001$). The prevalence of self-reported depression was significantly higher in those with a history of mental illness than in those without a history of mental illness (15.1% vs. 8.1%, $p = 0.001$). *Conclusion:* The prevalence of self-reported depression in a community sample of young adults is 11.1%. The prevalence of self-reported depression is significantly higher in females than in males and in those with a history of mental illness than in those without a history of mental illness.

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File# 614 85 Inc. v. Taxp. 614 85 Inc. v. Taxp.

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Abstract

**Nick McCallen's
machine code routine
will automatically find
and access the
character memory and
format of a VIC high
resolution screen.**

HI-RES VIC

IN ORDER TO UNDERSTAND the operation of the routine some understanding of the relationship between character memory and what appears on the screen is necessary too, for the benefit of those types have a brief explanation.

When the VIC is used in normal (text) mode, each screen location may store a character which is made up of eight rows of dots (pixels). Each pixel row is in fact one byte of the character memory, each of whose bits may be 'on' or 'off' to provide the dot on the screen which make up the character (see figure 1). Therefore the character memory is made up blocks of eight bytes, each block forming one character. In text mode these blocks are fixed.

In hi-res mode, a temporary character memory (scrn) is created in RAM, with all its bits initially 'off' to '0' or blank. Using the techniques outlined below, each bit may be turned on or off by a plotting routine. In order to do this in a controlled manner, each screen location is linked or 'mapped' to a fixed block of bytes in the temporary character memory. Each block may be of eight or sixteen bytes, according to how the VIC is set up.

A common technique of bit-mapping is shown in listing 1, and results in successive screen locations being mapped to successive C.M. byte blocks, as illustrated by figure 2. For the sake of illustration the screen is taken to start at \$8000, with the C.M. at \$9000 (\$4000).

As can be seen, this results in the C.M. bytes being displayed in successive blocks along the screen line. This is easy to achieve but makes life awkward for a printer with a

variable dot matrix, as is the case with many printers run off Commodore computers. To make a printout of hi-res screens easier to obtain on most Commodore, Intertek and other cheap dot matrix printers, a different bit mapping technique can be used.

In this alternative method, vertical columns of screen locations are mapped to successive C.M. bytes (see figure 3 and listing 2) so that along one block of seven pixel rows does not demand too much register juggling. It also maps the solution of another problem, instead of individual bytes representing a horizontal pixel row, the printer expects a byte to represent a VERTICAL column of pixels (see figure 4). The eighth bit in each pixel byte is not actually part of the character block which appears on paper.

There are two other advantages in using this

alternative method. Firstly the arrangement of the C.M. is constant whether we use 8x8 or 8x16 character blocks - 8x16 permits use of full screen memory, secondly, in the plotting routine, the Y is as a plotted dot, as any increments along the X, corresponds to an identical increment in the C.M. byte number. This reduces the calculations required in the plotting routine, and slightly increases the speed of a very slow BASIC routine.

Now we have to tackle the problem of converting horizontal C.M. bytes to vertical lines for the printer. This is where the detailed machine code provides the exact answer. Included in the 6502 code section are instructions which permit rotation of bytes to push the 'end-on' out of byte into a 'carry' bit. Another instruction can then be used to take the rest of the carry and push into the end of another byte (see figure 5). Using these

instructions we can strip out bit at a time off successive C.M. bytes, and load them into a vertical byte as required by the printer. Note that we have looked out in machine code as many as will state the who's routine at which no code the normal screen dump is slow enough in BASIC, is goodness knows how long a hi-res dump would take!

The Nigint routine

The routine has been written for maximum flexibility. According to absolute jump within the routine means that it can be loaded into any usable protected part of RAM by the editor provided suitable switches for the different configurations, possible with VIC are discussed later.

The operational part of the routine starts by loading the temporary character memory start address. The number of

```
10 REM-A TYPICAL BIT MAPPING TECHNIQUE
20 FOR C=0 TO 255 REM 256=NO. OF BYTES TO BE USED ON SCREEN
30 FOR ROW=0 TO 7 REM 7=NO. OF ROWS IN SCREEN
40 NEXT C
```

READY.

Listing 1

```
10 REM ALTERNATIVE METHOD OF BIT MAPPING SCREEN
20 REM ROW=ROW COUNT (0,1,2,3,4,5,6,7)
30 REM CL=COLUMN COUNT (0,1,2,3,4,5,6,7)
40 REM OS=OFFSET FROM $8000
50 REM CB=CHARACTER BLOCK
60 CB=7000 REM SCREEN SIZE
70 FOR ROW=0 TO 7 FOR CL=0 TO 7
80 OS=ROW*256+CL REM CALCULATE SCREEN OFFSET
90 CB=CL*16 REM CALCULATE ASSOCIATED CHARACTER BLOCK NUMBER
100 FOR CB=CB-1 TO 0
110 NEXT CL
120 NEXT ROW
```

READY.

Listing 2



CHARACTER TO BE PRINTED =CHAR(N)
 CHARACTER INFORMATION STARTS AT
 C.H.BASE+(N*8)

SCREEN LOCATION 7680 7691

C.H.BASE+(N*8)	-
C.H.BASE+(N*8)+1	-
C.H.BASE+(N*8)+2	-
C.H.BASE+(N*8)+3	-
C.H.BASE+(N*8)+4	-
C.H.BASE+(N*8)+5	-
C.H.BASE+(N*8)+6	-
C.H.BASE+(N*8)+7	-

-----8 BITS-----

Figure 1 Construction of 8 x 8 character on screen.

SCREEN.BASE	+1	+2	+3
7688	4096	4097	4098	4099
7702	4118	4119	4120	4121
7724	4140	4141	4142	4143

Figure 2 Bit mapping with screen

SCREEN.BASE	+1	+2	+3
7688	4096	4176	4256	4336
7702	4097	4177	4257	4337
7724	4098	4178	4258	4338

Figure 3 Alternative method for display

BIT NOS.							
BYTE 0	7	6	5	4	3	2	1 0
BYTE 1	7	6	5	4	3	2	1 0
BYTE 2	7	6	5	4	3	2	1 0
BYTE 3	7	6	5	4	3	2	1 0
BYTE 4	7	6	5	4	3	2	1 0
BYTE 5	7	6	5	4	3	2	1 0
BYTE 6	7	6	5	4	3	2	1 0
BYTE 7	7	6	5	4	3	2	1 0

C.H. BYTES

Figure 4 C.H. Bytes compared to printer bytes

BYTE	0	1	2	3	4	5	6	7
BIT	0	0	0	0	0	0	0	0
BIT	1	1	1	1	1	1	1	1
BIT	2	2	2	2	2	2	2	2
BIT	3	3	3	3	3	3	3	3
BIT	4	4	4	4	4	4	4	4
BIT	5	5	5	5	5	5	5	5
BIT	6	6	6	6	6	6	6	6
BIT	7	7	7	7	7	7	7	7

PRINTER BYTES

PRINTER BYTE

CARRY

C.H. BYTE

0 0 0 0 0 0 0 0

0

1 1 1 1 1 1 1 1

0 0 0 0 0 0 0 0

1

1 1 1 1 1 1 1 0

0 0 0 0 0 0 0 1

0

1 1 1 1 1 1 1 0

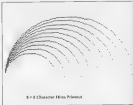
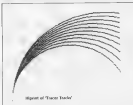
Figure 5 Transfer of bit 7 from C.H. byte to bit 0 of printer byte

```

10 PRINT "ENTER START LOCATION":INPUT L
20 READ A,B,C,D,E,F,G
30 IF A+B+C+D+E+F<0 THEN PRINT "DATA ERROR ON LINE"PEEK(63)+PEEK(64)+256 STOP
40 IF A<-1 THEN GOTO 60
50 PRINT "DATA CHECKED & ENTERED" PORT=8103000 NEXT PRINT "2" NEW
60 POKE L,A:POKE L+1,B:POKE L+2,C:POKE L+3,D:POKE L+4,E:POKE L+5,F
70 PRINT "LINE"PEEK(63)+PEEK(64)+256" OKAY"
80 L=L+6:GOTO 20
100 DATA 72,138,72,152,72,8, 514
110 DATA 169,4,178,168,255,32, 790
120 DATA 186,235,169,8,178,168, 948
130 DATA 32,189,255,32,192,255, 958
140 DATA 162,4,32,201,255,24, 678
150 DATA 73,9,144,41,15,281, 573
160 DATA 8,178,2,9,32,41, 268
170 DATA 39,18,18,178,282,134, 265
180 DATA 148,169,255,133,139,178, 1009
190 DATA 2,144,41,127,133,141, 508
200 DATA 173,3,144,24,41,127, 512
210 DATA 74,144,1,18,18,18, 243
220 DATA 19,133,142,133,143,169, 738
230 DATA 32,218,255,169,27, 781
240 DATA 32,218,255,169,16,32, 714
250 DATA 18,255,169,8,32,218, 876
260 DATA 233,163,146,32,218,255, 1867
270 DATA 24,165,143,291,7,144, 684
280 DATA 333,7,162,7,288, 623
290 DATA 178,163,8,153,143, 618
300 DATA 134,254,163,133,166,148, 958
310 DATA 164,141,133,251,134,252, 1875
320 DATA 32,253,162,8,288,193, 958
330 DATA 164,254,177,251,153,168, 1139
340 DATA 138,288,248,169,8, 771
350 DATA 33,255,169,8,168,254, 977
360 DATA 168,2,42,282,288, 644
370 DATA 249,9,128,32,218,255, 883
380 DATA 198,255,288,236,24,146, 1887
390 DATA 292,163,251,181,142,144, 1833
400 DATA 1,232,133,251,134,252, 1883
410 DATA 198,253,288,284,169,13, 1943
420 DATA 32,218,255,24,165,254, 948
430 DATA 181,139,132,139,144,2, 658
440 DATA 238,148,163,143,288,162, 1868
450 DATA 169,18,32,218,255,32, 713
460 DATA 231,255,49,184,168,184, 942
470 DATA 178,184,36,8,8,8, 378
480 DATA 1,8,8,8,8,8,-1

```

READY.



rows and columns used in the screen are also values used, so the routine can be used with any screen layout. The relevant control codes are sent to the printer at the start of each line, these groups of seven bytes are copied, reformatted into control bytes, and sent to the printer. Comments are used to ensure the correct number of cycles

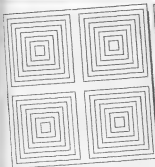
for each block, line, and character. At the start of each line a check is made for the number of post rows required, as the last line on the screen may not contain the full screen. Opening and closing files are handled, a table of row and column is taken care of with no file name, a file number of 4 and device number 4. Registers are saved

and restored at the respective ends of the routine. The header of the code is on the sections, labels \$B7518B and \$B75191. A group of seven rows is read into an array and row area. The last of these rows is then subjected to an AND operation. Most left, which results in the contents of bit 7 'falling off' into the carry as a

the other bits move left one place, and a zero is put into bit 0. The array, once, previously set to zero, is then subjected to a 8 Cycle Left operation, so that all its bits move left one place. As a result of a zero being loaded into bit 0, the contents of the carry are placed there, while the old contents of bit 7 are placed into the carry.



[illegible]



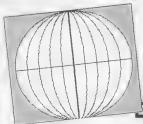
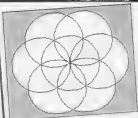
resulting it to zero.

This illustrates the difference between MATH and ROTATE operations. Each byte in the storage area has its bit 7 set (and off in this case) and the accumulator counts in all the bits. This is a logical byte. The byte is sent to the printer, and two spaces repeated for bits 8-9 and is on until all the seven bits have been completely elapsed. The next block is then read into the work area, and the process starts again.

Each byte sent to the printer sets a column of seven in the print head. Bit 8 sets the top needle, bit 9 sets the next one down, and so on down to bit 14. The printer prints, but must be set to logical (MATH). Loading the accumulator with zero at the start of each byte assembly simply prevents any stray values appearing in the printer.

Counter locations used

Reference	Working
\$00 C.M. Address L0	\$00 C.M. Address L0
\$00 C.M. Address H1	\$00 C.M. Address H1
\$00 H0 screen columns	\$00 C.M. counter
\$00 Total no. pixel rows on screen	\$00 Pixel rows in distance time
\$00 Two pixel rows left to print	\$00 Bit counter for shading



These counters are all in one page. \$00-\$0F are in the ROM function work area and \$10-\$1F are free locations.

The assembly language listing explains the detailed operation step by step, but one instruction requires further explanation. Line \$0400 to \$0400 is an order to show a branch back to line start, which would be out of range for a direct branch from \$0400. The alternative is an absolute jump, which was chosen to reject the positional flexibility of the counter.

Hires 1

This is a fully documented program using double-height characters, but mapping in such a way as to preserve all of the Hires routine. The program will run happily at 4K or more expansion.

The screen format is 22 columns of 18 rows, giving 220

```

3 REM
40
50 REM FULL SCREEN HIGH RESOLUTION USING DOUBLE HEIGHT CHARACTERS
60
70 PRINT "P-R-N SCREEN"
80
90 REM INITIALISE
100
110 PEEKBANK.PEEK(16384)OR 128 REM COLOUR RAM TO 16384
120 PEEK 16385,252 REM CANCELLED AT 4096/SCREEN AT 2560
130 PEEK 16387,149-80H (8 ROWS,84/2 CHARACTERS)
140 PEEK 16387,8 REM SCREEN 4 BORDER BLACK
150
160 REM SET-UP SCREEN
170
180 REM ROW-ROW COUNT (18 ROWS)
190 REM CL=COLUMN COUNT (32 COLS.)
200 REM CH=CHARACTER FROM BANK
210 REM CH=CHARACTER BLOCK
220 REM CH=ROW ROW SCREEN 80H
230 PEEK (48-30 REM TELL CH=SYSTEM WHERE SCREEN IS
240 CH=30H+44H+PEEK(16385+CH*128) REM START OF COLOUR MEMORY
250 CH=44H REM CANCELLED START
260 FOR ROW=0 TO 3 FOR CL=0 TO 31
270 CH=CH*CH+CL REM CALCULATE SCREEN OFFSET
280 CH=CH*80H REM CALCULATE ASSOCIATED CHARACTER BLOCK NUMBER
290 PEEK CH=CH+CL
300 PEEK CH=CH+7 REM SET FIXED COLOUR.
310 NEXT CL
320 NEXT ROW
330
340 REM-CLEAR CHARACTER MEMORY
350
360 FOR I=0 TO 320 REM SIZE OF C.M.(16*20*10)
370 PEEK CH+I=0
380 NEXT I
390
400 COLOUR 0:00 REM POWERS OF TWO
410
410 REM USER PROGRAM
420
430 REM SAMPLE PROGRAM "TRIGGER TRODS"
440
450 I=125
460 FOR T=0 TO 18 I=I+8
470 FOR W=0 TO 175
480 J=J+1,250-800 OF J08 THEN I=175-GO TO 490
490 I=5000:J=0
500 W=128+0
510 SCREEN 0:000 REM CHECK/PL0T
520 PRINT "X NEXT"
530 SET 48 OF RAM+THEN 300
540 FOR 300 3024 REM HORIZONTAL
550 END
5600
5700 REM CHECK VALUES IN RANGE.
5800
5900 IF FOR THEN I=0
6000 IF 10175 THEN I=175
6100 IF FOR THEN I=0
6200 IF 10150 THEN I=150
6300
6400 REM PL0T
6500
6600 CH=CH*CH+CL REM WHICH COLUMN
6700 REM Y VALUE = 804 NUMBER
6800 BY=CH*CH+CH+CL REM WHICH CHARACTER BYTE
6900 I=0 AND 7 REM WHICH BIT
7000 PEEK 84+PEEK(16385) OR PEEK(16387) REM TURN ON SINGLE PIXEL
7100 RETURN
7200
7300 REM PREPARE POWERS OF TWO ARRAY
7400
7500 REM POWERS OF TWO DECLARE POWERS OF TWO ARRAY
7600 FOR I=0 TO 7
7700 PEEK(16387+I*17)=0 REM EACH BIT HAS CORRESPONDING POWER OF TWO
7800 NEXT I
7900 SET 48H

```

READY.

Figure 1

screen bytes. As it uses double height characters, a character memory of 7520 (20 x 16 bytes x 23 bytes) is required. This when added to 500 bytes for screen memory uses up more space than desirable in the unexpanded VIC, so there would not be any room for a program. Therefore, a maximum of 18 expansion is essential. With just 18 expansion the pointers to top of memory should be set to Page 16, to protect the character memory, which starts at 4096, with the screen start at 7520. But, if the 18-bit routine is to be used, it is kept between Pages 11 & 16, so set top of memory to Page 15 with

POKE 16,15 : POKE 12,15 : CL

before loading anything. Hi-Print can then be located starting at 1840.

If using more than 18 expansion (i.e. more RAM) above cannot, it is necessary to save the bottom of memory to Page 12 before loading anything, in order to leave room for the VIC and screen before the program. This is done with

POKE 44,12 : POKE 8192,0 : V0H

The RAM is needed to store all BASIC pointers to the re-configuration in the routine the 18-bit routine can very conveniently be loaded anywhere between 1824 and 4096, in the program printed. V0H 1824 calls the routine coded at the bottom of this area. The scheme can easily be changed by altering the target address in the accompanying code program.

Whether this program runs the one for the unexpanded VIC or anything afterwards, they are merely demonstrations of technique. They are however, requested so that bit-mapping and clearing the screen can be observed.

Figure 2

This is a highly condensed and display modified version of Hires 3, written to run on the basic VIC. The screen format is reduced to 18 rows x 32 columns and uses 8 x character Values used in simulation and

programming are obvious: y different, but the techniques are the same.

Character memory is located at \$128 up, leaving just \$5 for the program and Hypertek Machine. As the character memory requires 10*10*8 = 800 bytes, the x and y axes at 4000, leaving a large enough gap between it and the screen start at 7680 for the Hypertek routine — as long as we are careful not to use any of these numbers accidentally when plotting onto the x/y.

A good starting address for the routine in this case would be at the beginning of Page 29 (i.e. 7544). In fact this would permit a few more lines to be used for the basic screen.

If using the accompanying code, it is necessary to set the top of memory pointer (at Page 25) to:

POKE \$4,9 : POKE \$2,9 : CL

The loader is then used to locate the routine, and then

the pointers must be reset to Page 20 by the same method.

In both programs, the X range is 0 to 10000, columns, while the Y (rows) range is from 0 to 10000, lines in Program 2, and 0 to 75000 lines in Program 1.

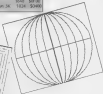
Basic loader

The loader requests a start location for the Hypertek routine. It then performs a checksum for each set of 80 data values, confirming each line if an error is detected, the program stops and the offending line number is displayed. After running successfully the program fills the model, leaving the routine safely placed at the desired position.

Suggested Start Addresses

Unexpanded VIC	7424	\$7000
VIC < 3K	8448	\$8700
VIC > more than 3K	1024	\$0400

These addresses are used in the VIC call to assume the Hypertek routine.



```
80 PRINT "I" POKE36869:253 POKE36867:28 POKE36873:8
100 $D=7680-CH*38400:CH=$120
200 FOR $D=9709:FOR CL=9709:OS=$D*23+CL:CB=CL*18+$D
300 POKE$B+OS,CB:POKE$B+OS,7:NEXTCL:NEXT$D
320 FOR I=0 TO 1760:POKE$B+1,0:NEXT
400 $=00:FOR T=17010 $=$+5:FOR K=970175 J=$*2,8*H*XXX:IF J<0 THEN $=1/3:GOTO430
420 $=20R(J):Y=73-K*205253680
430 NEXTK:NEXTT
500 GET$B:IF $D="" THEN $=0
510 SYS7424:END
5200 IFX<0 THEN $=0
5300 IFX<175 THEN $=175
5400 IFY<0 THEN $=0
5500 IFY<73 THEN $=73
5100 C=INT($/8):$V=CH*Y+(C*80):$I=$*807:POKE$B,(21*(7-$I))/8:POKE$B,$V:RETURN
```

READY.

Steve D

initial positions. Then we can complete the program by writing the subroutines for moving the sprites.

The eight sprites will each have their own colour and, when they are first displayed, a pointer. Each pointer can be found by giving a column and a row. To represent the colours and positions we can use three parallel arrays, as shown in Figure 1. The arrays A, C and R will hold, respectively, the X and Y coordinates and the colour of the sprites. The two columns and one row for sprite 1 will be held in element 1 of the relevant array.

To give the sprites identical pointers (shown in Figure 2), we start the program with Listing 1.

After this, we make the program clear the screen and leave a gap in the line numbering to fall into with the initialisation for the subroutines. We store a sprite description to be shared by all the sprites. We have described the mechanics of sprite movement in an earlier project, and using the same description for a fish-shaped sprite is that we used before given in Listing 4.

Now, with the sprite description stored, we can associate it with a sprite by making the eight locations pointing to it the one with address 240 point to it. We give the sprites their colour by copying a hexadecimal colour from the array H to the block starting at 5125 and, similarly, give them their initial positions by transferring the column and row numbers from the arrays C and R to the block from 5126 to 5128. This is done by Listing 3.

```
170 FOR J=0 TO 7
180 FOR I=0 TO 7, 15
190 FOR S=0 TO 3, 11, 21
200 FOR X=0 TO 240, 5121
210 FOR Y=0 TO 240, 5121
220 NEXT J
Listing 3
```

Even now, the sprites won't move, because we must turn them on. This can be done for all the sprites with

```
230 FOR S=0 TO 255, 255
```

3, moving the part of the program consisting of lines 18



Figure 1: The parallel arrays used to initialise the sprites

```
110 X=0: Y=0: T=0: A=0
1200 Y=PEEK(51251)
1310 Y=Y+2
1420 FOR S=0 TO 7
1530 IF Y>220 OR Y<0 THEN Y=Y+5
1640 RETURN
Listing 4
```

```
2000 X=PEEK(51254)
2110 X=X+2
2220 FOR S=0 TO 7
2330 IF X>220 OR X<0 THEN X=X+5
2440 RETURN
Listing 5
```

```
4000 T=T+1/50
4010 IF T>240 THEN T=0
4020 X=(40+50+500+T)/7: Y=(40+50+500+T)/7
4030 FOR S=0 TO 7: PEEK(51251, S)
4040 RETURN
Listing 6
```

```
5000 AND=1/255
5010 IF A=0 THEN A=0
5020 X=(40+50+500+T)/7: Y=(40+50+500+T)/7
5030 FOR S=0 TO 7: PEEK(51251, S)
5040 RETURN
Listing 7
```

to 240 will show the eight coloured sprites in their initial positions. If you include lines 240 to 270, though, you will get an error message, for we haven't got round to writing the subroutines which they call yet. If you want to test the whole thing up to line 230, you can include 'dummy' subroutines that do absolutely nothing except establish that the structure of the program is a right by making a series of ones such as

```
505 RETURN
506 RETURN
507 RETURN
508 RETURN
```

Now we had better replace these empty subroutines with routines that will actually move the sprites. We shall not write all eight, but just those for the odd-numbered sprites to make them move along the paths that are indicated in Figure 2.

Sprite number 1 is to move up and down along a vertical path, bouncing off imaginary barriers at each end. This means that it stays in the same column, so the line, screen need not change that.

Its row must keep changing, though. If we store the amount by which it changes under Y, and change Y in line 110, along with other variables for the other subroutines, then the subroutines must take the new position of sprite 1 from location 51251, and the contents of Y to it, and put the new value back. This will automatically move the sprite to the new position.

The only other thing that we need to do is to test whether the sprite has reached the top or bottom of the screen and, if it has, to change the sign of the number stored in Y to make the sprite bounce back. Since the subroutines for sprite 1 start at line 5000, this gives us, using 5, the subroutines for sprite 3 follows the same line. See Listing 8.

The path for sprite 7 is a row across at (140,140) with radius 10. This means that for any value of an angle T the point (140+10*cos(T), 140+10*sin(T)) is on the circle, and as the value of T increases the corresponding point moves

and clockwise around the circle. Also, T10 will give the initial position of spring 7. So, with T initialized to 0 on line 110, we can move spring 7 round its circular path with listing 8.

Although the path of spring 5 is an elliptical one, this spring can be moved along its path the same way by listing 9.

It is left to you to write subroutines to move the even-numbered springs. The listing of the program as far as we have developed it is given in Program 1.

Moving on

At this stage, we can take developments a step further by turning all the even-numbered springs, since there is no way to move them, and use the left spring collision detection to turn them on again. This will illustrate how the collision detection works, and in so doing will provide the basis on which some sophisticated effects can be built. For instance, it can be elaborated so that when two springs collide one of them is wiped out or, perhaps, a new one is born.

At the start of the program, we can use another array, Q, parallel to the array for the hue, column and row, to record which springs are actually on and when off. In element 0, records that spring 0 is on by containing a 1 and that it is off by holding a 0. The array can be declared, initialized to show that only the odd-numbered springs are on, and then used to turn just those springs on with the appropriate and instructions in listing 10.

We can then use the array Q to ensure that the program only bothers to try to move springs that are on by adding the following line to the control movement (starting 601) of the program:

```
600 IF Q(X)=0 THEN GOTO 606
```

Now, the spring collisions are recorded in location 5127. What happens, for example, is that when springs 1 and 3 collide, bits 3 and 5 in this location are set. It is also important to remember that the act of setting a bit

Program Listing 1

```

100 SPR H(7), C(7), R(7)
200 FOR K=0 TO 7
300 H(K)=0
400 NEXT K
500 H(7)=0
600 SPR=68.00:140.00
700 SPR=128.00:128.140
800 SPR=128.00:140.00
900 SPR=68.00:68.140
100 PPR=17
110 Y=10 X=5: T=0 R=0
120 FOR K=0 TO 60 STOP 3
130 POKE 532+K, 1: POKE 532+K+1, 1: POKE 532+K+2, 0
140 IF K=18 THEN POKE 532+K, 255: POKE 532+K+1, 255: POKE 532+K+2, 255
150 IF K=30 THEN POKE 532+K, 255: POKE 532+K+1, 255: POKE 532+K+2, 255
160 NEXT K
170 FOR J=0 TO 7
180 POKE 532+J, 13
190 POKE 532+J+1, K(1)
200 POKE 532+J+2, C(J)
210 POKE 532+J+3, R(J)
220 NEXT J
230 POKE 532+5, 255
240 FOR K=0 TO 7
250 ON K+1 GOTO 250, 500, 1000, 2000, 2500, 3000, 3500, 4000
260 NEXT K
270 GOTO 340
300 RETURN
1000 Y=PRG(532+1)
1010 Y=PRG
1020 POKE 532+1, Y
1030 IF Y=255 OR Y=0 THEN Y=Y-1
1040 RETURN
1050 RETURN
2000 R=PRG(532+4)
2010 R=PRG
2020 POKE 532+4, R
2030 IF R=255 OR R=0 THEN R=R-1
2040 RETURN
2500 RETURN
2510 RETURN
3000 R=PRG(532+5)
3010 IF R=255 THEN R=0
3020 R=(140+R*255)/256: Y=(140+R*255)/256
3030 POKE 532+5, R: POKE 532+5, Y
3040 RETURN
3500 RETURN
4000 T=T+1/50
4010 IF T=254 THEN T=0
4020 X=(140+R*255)/256: Y=(140+R*255)/256
4030 POKE 532+6, X: POKE 532+6, Y
4040 RETURN

```

```
254 Z=PRG(532+3)
```

```
254 IF Z(1) AND Z(2) THEN GOSUB 5000
```

```
255 Z=Z1
```

Listing 12

```

10 DIM H(7), C(7), R(7), Q(7)
15 P=0
40 Q(K)=K-2*INT(K/2)
44 IF Q(K)<0 THEN P=P+2*K
220 POKE 53247, P

```

Listing 10

```

900 G=0
910 FOR L=0 TO 7
920 IF G(L)=0 THEN G(L)=G
930 NEXT L
940 IF G=0 THEN RETURN
950 G=INT(POKE 53247, P/255) OR 254
960 RETURN

```

Listing 11

Initials clears \mathbf{G} . Then \mathbf{G} we want to do at the moment is to use an \mathbf{H} value to change the turning on of pixels. For \mathbf{H} we now add the line

```

P5 IF PEEK(53247)=0 THEN
GOSUB 900

```

This will test and clear the \mathbf{G} value that records the rollers. Also we introduced unit movements calling a subroutine to turn on pixels. Since a roller can be activated, all our subroutines have to do is turn the array \mathbf{Q} to find a value that is off, and then update \mathbf{Q} and turn the spools on. This can be done by Listing 11.

Actually, the way that the subroutines are triggered is not entirely satisfactory. This is because once two spools meet they can stay in contact for some time. Although the collision is recorded when

they first meet, the act of rolling the rollers can separate them, and if the spools are off, in contact the next time around, the collision is recorded again. For this reason, the meeting of one pair of spools can be recorded several times as a roller turns and corresponding \mathbf{P} will turn on several spools. This is not exactly what we wanted. To avoid it we must replace line 250 in \mathbf{H} routine designated by entry, we must use "Has a roller been activated and is it a different roller from the last one?" We can do this by adding

```

105 IF PEEK(53247)

```

to \mathbf{H} for the calls, as appears in the next page. Then we should replace line 250 in Listing 12. The complete program is shown in Program 2.

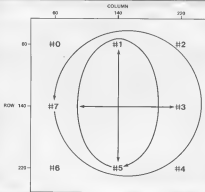


Figure 3. Initial positions and paths for the spools.

Program Listing 2

```

10 DIM A(100)
11 DIM B(100)
12 FOR A=0 TO 99
13   B(A)=0
14   FOR C=0 TO 99
15     IF A=C THEN
16       B(C)=1
17     ELSE
18       B(C)=0
19     END IF
20   NEXT C
21 NEXT A
22 FOR A=0 TO 99
23   FOR B=0 TO 99
24     IF A=B THEN
25       B(B)=1
26     ELSE
27       B(B)=0
28     END IF
29   NEXT B
30 NEXT A
31 FOR A=0 TO 99
32   FOR B=0 TO 99
33     IF A=B THEN
34       B(B)=1
35     ELSE
36       B(B)=0
37     END IF
38   NEXT B
39 NEXT A
40 FOR A=0 TO 99
41   FOR B=0 TO 99
42     IF A=B THEN
43       B(B)=1
44     ELSE
45       B(B)=0
46     END IF
47   NEXT B
48 NEXT A
49 FOR A=0 TO 99
50   FOR B=0 TO 99
51     IF A=B THEN
52       B(B)=1
53     ELSE
54       B(B)=0
55     END IF
56   NEXT B
57 NEXT A
58 FOR A=0 TO 99
59   FOR B=0 TO 99
60     IF A=B THEN
61       B(B)=1
62     ELSE
63       B(B)=0
64     END IF
65   NEXT B
66 NEXT A
67 FOR A=0 TO 99
68   FOR B=0 TO 99
69     IF A=B THEN
70       B(B)=1
71     ELSE
72       B(B)=0
73     END IF
74   NEXT B
75 NEXT A
76 FOR A=0 TO 99
77   FOR B=0 TO 99
78     IF A=B THEN
79       B(B)=1
80     ELSE
81       B(B)=0
82     END IF
83   NEXT B
84 NEXT A
85 FOR A=0 TO 99
86   FOR B=0 TO 99
87     IF A=B THEN
88       B(B)=1
89     ELSE
90       B(B)=0
91     END IF
92   NEXT B
93 NEXT A
94 FOR A=0 TO 99
95   FOR B=0 TO 99
96     IF A=B THEN
97       B(B)=1
98     ELSE
99       B(B)=0
100    END IF
101  NEXT B
102 NEXT A
103 FOR A=0 TO 99
104   FOR B=0 TO 99
105     IF A=B THEN
106       B(B)=1
107     ELSE
108       B(B)=0
109     END IF
110   NEXT B
111 NEXT A
112 FOR A=0 TO 99
113   FOR B=0 TO 99
114     IF A=B THEN
115       B(B)=1
116     ELSE
117       B(B)=0
118     END IF
119   NEXT B
120 NEXT A
121 FOR A=0 TO 99
122   FOR B=0 TO 99
123     IF A=B THEN
124       B(B)=1
125     ELSE
126       B(B)=0
127     END IF
128   NEXT B
129 NEXT A
130 FOR A=0 TO 99
131   FOR B=0 TO 99
132     IF A=B THEN
133       B(B)=1
134     ELSE
135       B(B)=0
136     END IF
137   NEXT B
138 NEXT A
139 FOR A=0 TO 99
140   FOR B=0 TO 99
141     IF A=B THEN
142       B(B)=1
143     ELSE
144       B(B)=0
145     END IF
146   NEXT B
147 NEXT A
148 FOR A=0 TO 99
149   FOR B=0 TO 99
150     IF A=B THEN
151       B(B)=1
152     ELSE
153       B(B)=0
154     END IF
155   NEXT B
156 NEXT A
157 FOR A=0 TO 99
158   FOR B=0 TO 99
159     IF A=B THEN
160       B(B)=1
161     ELSE
162       B(B)=0
163     END IF
164   NEXT B
165 NEXT A
166 FOR A=0 TO 99
167   FOR B=0 TO 99
168     IF A=B THEN
169       B(B)=1
170     ELSE
171       B(B)=0
172     END IF
173   NEXT B
174 NEXT A
175 FOR A=0 TO 99
176   FOR B=0 TO 99
177     IF A=B THEN
178       B(B)=1
179     ELSE
180       B(B)=0
181     END IF
182   NEXT B
183 NEXT A
184 FOR A=0 TO 99
185   FOR B=0 TO 99
186     IF A=B THEN
187       B(B)=1
188     ELSE
189       B(B)=0
190     END IF
191   NEXT B
192 NEXT A
193 FOR A=0 TO 99
194   FOR B=0 TO 99
195     IF A=B THEN
196       B(B)=1
197     ELSE
198       B(B)=0
199     END IF
200   NEXT B
201 NEXT A
202 FOR A=0 TO 99
203   FOR B=0 TO 99
204     IF A=B THEN
205       B(B)=1
206     ELSE
207       B(B)=0
208     END IF
209   NEXT B
210 NEXT A
211 FOR A=0 TO 99
212   FOR B=0 TO 99
213     IF A=B THEN
214       B(B)=1
215     ELSE
216       B(B)=0
217     END IF
218   NEXT B
219 NEXT A
220 FOR A=0 TO 99
221   FOR B=0 TO 99
222     IF A=B THEN
223       B(B)=1
224     ELSE
225       B(B)=0
226     END IF
227   NEXT B
228 NEXT A
229 FOR A=0 TO 99
230   FOR B=0 TO 99
231     IF A=B THEN
232       B(B)=1
233     ELSE
234       B(B)=0
235     END IF
236   NEXT B
237 NEXT A
238 FOR A=0 TO 99
239   FOR B=0 TO 99
240     IF A=B THEN
241       B(B)=1
242     ELSE
243       B(B)=0
244     END IF
245   NEXT B
246 NEXT A
247 FOR A=0 TO 99
248   FOR B=0 TO 99
249     IF A=B THEN
250       B(B)=1
251     ELSE
252       B(B)=0
253     END IF
254   NEXT B
255 NEXT A
256 FOR A=0 TO 99
257   FOR B=0 TO 99
258     IF A=B THEN
259       B(B)=1
260     ELSE
261       B(B)=0
262     END IF
263   NEXT B
264 NEXT A
265 FOR A=0 TO 99
266   FOR B=0 TO 99
267     IF A=B THEN
268       B(B)=1
269     ELSE
270       B(B)=0
271     END IF
272   NEXT B
273 NEXT A
274 FOR A=0 TO 99
275   FOR B=0 TO 99
276     IF A=B THEN
277       B(B)=1
278     ELSE
279       B(B)=0
280     END IF
281   NEXT B
282 NEXT A
283 FOR A=0 TO 99
284   FOR B=0 TO 99
285     IF A=B THEN
286       B(B)=1
287     ELSE
288       B(B)=0
289     END IF
290   NEXT B
291 NEXT A
292 FOR A=0 TO 99
293   FOR B=0 TO 99
294     IF A=B THEN
295       B(B)=1
296     ELSE
297       B(B)=0
298     END IF
299   NEXT B
300 NEXT A
301 FOR A=0 TO 99
302   FOR B=0 TO 99
303     IF A=B THEN
304       B(B)=1
305     ELSE
306       B(B)=0
307     END IF
308   NEXT B
309 NEXT A
310 FOR A=0 TO 99
311   FOR B=0 TO 99
312     IF A=B THEN
313       B(B)=1
314     ELSE
315       B(B)=0
316     END IF
317   NEXT B
318 NEXT A
319 FOR A=0 TO 99
320   FOR B=0 TO 99
321     IF A=B THEN
322       B(B)=1
323     ELSE
324       B(B)=0
325     END IF
326   NEXT B
327 NEXT A
328 FOR A=0 TO 99
329   FOR B=0 TO 99
330     IF A=B THEN
331       B(B)=1
332     ELSE
333       B(B)=0
334     END IF
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1328   FOR B=0 TO 99
1329     IF A=B THEN
1330       B(B)=1
1331     ELSE
1332       B(B)=0
1333     END IF
1334   NEXT B
1335 NEXT A
1336 FOR A=0 TO 99
1337   FOR B=0 TO 99
1338     IF A=B THEN
1339       B(B)=1
1340     ELSE
1341       B(B)=0
1342     END IF
1343   NEXT B
1344 NEXT A
1345 FOR A=0 TO 99
1346   FOR B=0 TO 99
1347     IF A=B THEN
1348       B(B)=1
1349     ELSE
1350       B(B)=0
1351     END IF
1352   NEXT B
1353 NEXT A
1354 FOR A=0 TO 99
1355   FOR B=0 TO 99
1356     IF A=B THEN
1357       B(B)=1
1358     ELSE
1359       B(B)=0
1360     END IF
1361   NEXT B
1362 NEXT A
1363 FOR A=0 TO 99
1364   FOR B=0 TO 99
1365     IF A=B THEN
1366       B(B)=1
1367     ELSE
1368       B(B)=0
1369     END IF
1370   NEXT B
1371 NEXT A
1372 FOR A=0 TO 99
1373   FOR B=0 TO 99
1374     IF A=B THEN
1375       B(B)=1
1376     ELSE
1377       B(B)=0
1378     END IF
1379   NEXT B
1380 NEXT A
1381 FOR A=0 TO 99
1382   FOR B=0 TO 99
1383     IF A=B THEN
1384       B(B)=1
1385     ELSE
1386       B(B)=0
1387     END IF
1388   NEXT B
1389 NEXT A
139
```

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A.P. and D.J. Stephenson
tackle the problem of using
machine code to sort string
arrays into order.

SORTING STRINGS IS MORE DIFFICULT than sorting numbers, because of the manner in which the BASIC interpreter stores strings. But, if it is no good writing, or even attempting to write, a machine code string (or) until the storage mechanism is thoroughly understood.

String descriptors

Strings are controlled by string descriptors which consist of three bytes as shown in Figure 10.1. The first byte holds the string length and refers to the number of bytes occupied by the string which, of course, is the same as saying the number of characters in the string. This then is the number of characters in a string and is the same as saying the number of bytes in the string is represented by 255. The 16th general purpose in any byte, including the string length byte, is 255. The other two bytes in the string descriptor give the string address on the basis of low byte, high byte where the string is stored. They are merely address pointers, not the string themselves. The actual string consisting of the equivalent ASCII codes is stored in sequential memory locations starting at the address given by the address pointer in the string descriptor.



Figure 10.1: String descriptor



MASTERING MACHINE CODE

Thus, in the part of a sort routine where two strings have to be swapped (because they happen to be in the wrong order), we swap over the descriptors rather than the strings themselves. When sorting, then, it is only necessary to ensure that the string descriptors are in order. The strings themselves can be left in exactly the same haphazard order they were in before the sort process began. This will clearly reduce the requirement for the sort. In effect, we are trading the BASIC interpreter by managing its string array using a collection of string descriptors.

How string arrays are stored

A string array is a collection of separate strings, each stored under a common name. We would therefore expect the format for handling string arrays to be more complicated than single strings because, in most cases, not only for the array name, but also for the number of dimensions in the array together with the array type. However, string arrays are handled in a similar way to integer arrays. See Figure 10.2.

Bytes 1 and 2
These are reserved for the array name. In order for the interpreter to

array name. In order for the interpreter to distinguish string arrays from integer or floating point arrays, the first byte is the ASCII code of the first character of the array name. (You will remember from last month's discussion, that the first byte in the integer array format is the ASCII code + 140.) The second byte is either the second character of the array name + 140 or, if there isn't one, just 140. As an example, if we would have 140 (the ASCII code for 0) in the first byte and 148 (the ASCII code for the second byte). On the other hand, if the array name was BCS, the second byte would be the sum of the ASCII code for (144) and the current 140, making a total of 284.

Bytes 3 and 4

These are address pointers to the next array arranged in the order low byte, high byte.

Byte 5

The number of dimensions in the array, obviously stored in 255.

Bytes 6 and 7

The array size, in high-byte, low-byte order for a change. The three-byte string information block then follows on after the heading information.

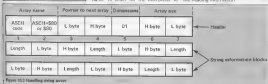


Figure 10.2: Handling string arrays

```

10 BUBBLE SORT
20 10F A STRING ARRAY
30 NUMBER = #FB
40 BOUNT = #FD
50 ONE = #57
60 TWO = #59
70 FLAG = #FF
80 STRING1 = #58
90 STRING2 = #5D
100 LENGTH1 = #5F
110 LENGTH2 = #60
120 **$C000
130 SEC
140 LDA NUMBER
150 SBC #1
160 STA NUMBER
170 BCS LOOP1
180 DEC NUMBER+1
190 LOOP1
200 CLC
210 LDA #2F
220 ADC #FOA
230 STA TWO
240 LDA #30
250 ADC #0
260 STA TWO+1
270 LDA #0
280 STA FLAG
290 STA COUNT
300 STA COUNT+1
310 LDA TWO+1
320 STA ONE+1
330 LDA TWO
340 STA ONE
350 CLC
360 ADC #3
370 STA TWO
380 BCC SKIP
390 INC TWO+1
400 LDY #0
410 LDA (ONE),Y
420 STA LENGTH1
430 LDA (TWO),Y
440 STA LENGTH2
450 INY
460 LDA (ONE),Y
470 STA STRING1
480 LDA (TWO),Y
490 STA STRING2
500 INY

```

```

510 LDA (ONE),Y
520 STA STRING1+1
530 LDA (TWO),Y
540 STA STRING2+1
550 LDY #0
560 LOOP3
570 LDA (STRING2),Y
580 CHP (STRING1),Y
590 BCC SWOP
600 DNE NOSWOP
610 INY
620 CPY LENGTH1
630 BGE NOSWOP
640 CPY LENGTH2
650 BGE SWOP
660 STY FLAG
670 LDA (ONE),Y
680 LOOP4
690 TAX
700 LDA (TWO),Y
710 STA (ONE),Y
720 TXA
730 STA (TWO),Y
740 DEY
750 BPL LOOP4
760 NOSWOP
770 INC BOUNT
780 BNE SKIP2
790 INC COUNT+1
800 LDA BOUNT
810 CHP BOUNT
820 BNE LOOP2
830 LDA COUNT+1
840 CHP BOUNT+1
850 BNE LOOP3
860 LDA FLAG
870 BCC FLAGCLEAR
880 SEC
890 SBC #1
900 STA NUMBER
910 BCS SKIP3
920 DEC NUMBER+1
930 LDA NUMBER
940 BNE STAGE
950 LDA NUMBER+1
960 BNE STAGE
970 FLAGCLEAR RTS

```

Program 10.1 Routine to test machine code

```

10 REM TESTING THE MACHINE CODE
20 REM STRINGS SORTING ROUTINE
30 PRINT CHR$(147):INPUT "ENTER NUMBER OF
STRINGS"
40 REM FILL AND DISPLAY ARRAY
50 DIM A$(1023)
60 FOR N=1 TO 25
70 B$(N)=
80 A$(10+RND(1))+1
90 FOR I=1 TO 42
100 B$(I)=CHR$(RND(1))
110 C$(N)=C$(N)+B$(I)+63
120 B$(I)=B$(I)
130 NEXT
140 B$=""
150 PRINT A$(N)
160 NEXT
170 B$=""
180 B$=""
190 B$=""
200 REM PREPARE CALL PARAMETER
210 B$=""
220 L$(1)=B$+"*****"
230 B$=""
240 POKE 251,L$
250 POKE 252,100
260 T1$=""
270 REM CALL MACHINE CODE ROUTINE
280 B$=""
290 T2$=T1$+60+0.5
300 REM DISPLAY SORTED STRING ARRAY
310 FOR N=1 TO 25
320 PRINT A$(N)
330 NEXT
340 B$=""
350 PRINT "*****SORTED IN "T2$"SECONDS"
READY.

```

Program 10.14 Hex dump of Program 10.1

```

0000 38 43 F8 87 01 85 F8 80
0008 02 C6 FC 18 A8 2F 49 0A
0010 85 59 A5 30 49 00 85 5A
0018 A9 00 85 FF 85 F8 85 FC
0020 A5 5A 85 58 A5 57 85 57
0028 18 49 03 85 89 00 02 84
0030 5A 40 00 81 57 85 57 81
0038 57 85 40 C8 81 57 85 58
0040 81 57 85 C8 81 57 85
0048 5C 81 57 85 5E A0 60 81
0050 5C 01 58 70 0F 50 1E C8
0058 C4 5F F0 19 C4 40 F0 04
0060 D0 8D D0 A7 A0 02 84 FF
0068 81 57 AA 81 59 91 57 8A
0070 91 59 88 10 F3 66 F0 80
0078 02 86 FE A5 F0 C8 F8 D0
0080 9F A5 FE C8 FC 00 99 A5
0088 FF F0 13 A5 F8 38 87 01
0090 85 F8 80 04 C6 FC A5 F8
0098 D0 C8 A5 FC 80 C4 40 0E

```

Understanding the source code

A flow diagram of the rather complex string comparison section of Program 10.1, as shown in Figure 10.1, lies in conjunction with the following line-by-line treatment of the mechanism.

Lines 30 to 110 assign labels to all used locations. All locations used for storage are on page zero.

Lines 120 to 180 (except 1 from the input quantity stored in NUMBER and L\$(N)=) .

Lines 190 to 250 set the array space start address which is shown stored in locations \$26 and \$40. An offset of \$2A is added in order to point to the first element of the array. This also skips the array (240) element which may contain an array header and thus will not be included in the sort. The result is placed temporarily in address pointer TWO (two bytes).

Lines 260 to 280 initialize the swap flag FLAG (1 byte) and the loop counter, COUNT (two bytes) to zero.

Lines 290 to 310 copy the contents of pointer TWO to pointer ONE (two bytes each).

Lines 340 to 360 increment pointer TWO by adding 1, because it must point to the next string information block three locations away.

Lines 370 to 470 increment addressing to fetch the length of the first string from the string information block. This data is stored in pointer ONE.

Armed with this information on the design of string arrays, we can now turn to the study of Program 10.1.

Bubble sort string array

The bubble, and sometimes degraded, algorithm known as the bubble sort is again used. In BASIC it is a horrible suggestion but in much code it is quite acceptable and has the advantage of using little memory. Comparison with the integer version, Program 9.1, given last month's issue, shows that they both have a good deal in common. Not every one will have an assembler for entering Program 10.1 (even because of in-source-code-to-the-assembly machine code bytes (the object code is given in the form of a hex dump shown as Program 10.14).

To enter the machine code bytes, they can be PC8010 individually, starting with the first byte at address \$7112. However,

remember that the Commodore 64 does not recognize hex bytes which means that you would have the boring task of converting them all to decimal first—and without making one single error! Fear not. Type in Program 10.1 which accepts data entries in hex.

Once you have entered the code, you won't know whether you have entered everything correctly or, indeed, whether the program works at all. This is where Program 10.2 comes in handy. Assuming the machine code bytes are already in a block of memory starting at decimal address \$7112, the program will call on the machine code and try everything out for you including the time the machine takes to execute the sort. You don't have to provide test strings because the program generates them randomly. Try it out with only a few strings to start with then double the number while noting how execution time increases rather steeply each time.

Program 14.3 Putting a hex dump into memory

```

10 REM PUTTING A HEX DUMP INTO MEMORY
20 REM STARTING AT ADDRESS 8000H
30 INPUT "HOW MANY BYTES IN HEX DUMP?":N
40 B=40952
50 FOR L=0 TO N-1
60 READ D$
70 PGM=ASC(D$)+48
80 GOSUB 900 OR GOTO 400, L+1-48
90 IF PGM>9 THEN PGM=PGM-7
100 IF PGM>9 THEN PGM=PGM-7
110 BTC=164P-DC+655
120 POKE B+L,BTC
130 NEXT
140 DATA 48,48,48,48,48,48,48,48,48,48
150 DATA 48,48,48,48,48,48,48,48,48,48
160 DATA 48,48,48,48,48,48,48,48,48,48
170 DATA 48,48,48,48,48,48,48,48,48,48
180 DATA 48

```

lines 400 to 410 do the same for the second string. The data addresses pointer TWD.

Lines 440 to 530 obtain the main addresses of the string pair, again using indirect addressing. The addresses are stored in the page zero locations STRPG1 and STRPG2 two bytes each.

Line 540 clears the *i* register which doubles as the string character counter. Lines 550 to 580 compare the ASCII codes of the string character pairs. The same string detection is wrapped over if they are in ascending order. Otherwise, they are left alone.

Line 590 increments the string character counter.

Lines 600 to 610 compare the length of the first string L1*GTH1 to the character counter. If they are equal, no swap is required.

Lines 620 to 630 compare the second string length L2*GTH2 to the character counter and, if equal, a swap is made. Line 640 forces a branch back to 1000H ready for comparing the ASCII codes of the next pair of string characters. The cycle continues until neither of the above comparisons has resulted in a swap or a no swap is made.

Line 660 is an out-of-range branch point. It is due to the limit on displacements imposed by relative addressing which would have been exceeded in line 640. The method is an alternative to using an absolute (JUMP) which would cause problems if the object code were to be relocated.

Line 680 stores 1 in the *i* register. This acts as a byte counter and also as an index register for indirect indexed addressing. Line 670 sets the swap flag. Any non-zero value stored in the location later left in AG indicates that a swap has taken place. Lines 690 to 710 swap the 16-bit string descriptors, one byte at a time, using the *X*

index register as a temporarily intermediate swap location. The remaining lines 720 to 750 are similar to lines 530 to 740 of the string sort and are given last month.

Using the routine

It is important to remember that, in use, the string array to be sorted must be the last DIMENSIONED in BASIC. This is because the start address, at the start to be sorted, is calculated from the start of the array space stored by the Commodore-64 at locations 538 (low byte) and 539 (high byte). If the above is not adhered to the sort routine will simply not work.

The total code is present in memory from 8000H (10752 decimal) onwards.

In order to use it all we need supply is the number of array elements to be included in the sort. For example, say that the total number of strings stored in the array is placed in the variable *N*. The following two lines of BASIC will split this number into a high byte and low byte component ready for POKEing into locations 538 and 539 (251 and 252 decimal).

```

100 H%=INT(N/256)
200 L%=INT(N-256*H%)

```

The values are POKE'd with the following two lines:

```

300 POKE 251,H%
400 POKE 252,L%

```

Finally, the routine is called from BASIC by 575 4910.

Table 10.1 is a general guide to the sorting speed to be obtained for various random length strings. The table reveals that it takes approximately four times as long to sort double the number of strings.

Figure 10.1 Flow diagram of string comparison

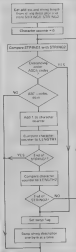


Table 10.1

No of random strings	Typical sort time
100	1 sec
200	4 sec
300	8 sec
400	11 sec
500	20 sec
1000	90 sec

These sets of routines, more efficient algorithms but few use less memory for those interested in even faster methods using the 'dramatic' incremental sort algorithm are our books 'Advanced machine code programming for the Commodore 64' or '7 meg routines and databases for the Commodore 64' published by Granada/Collins.



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Only hertz when I type

Last month, I gave you a program, called HERTZ, to type in to get the high bytes and low bytes of the hertz frequency of the Hertz. Since I wrote that, I have been seriously

informed that the fraction (derived from the speed of the 64's internal clock) I gave was based on the American standard which is widely inaccurate. (Typical) So, when I said ...

SO FAR, WE HAVE COVERED computer music on the 64 in fairly general terms. Having failed in the course with a thick pencil, we can now pen in the fine detail that we missed! This time we'll be sampling each delight as synchtronisation, ring modulation, more about waveforms, the ubiquitous oscilloscope, plus HERTZ II, special effects and finally some tips on intuitive synthesis. With the frequency of you going "what?!", as we begin ...

Program Listing 2

```
100 REM ***** HZ BY THERMIST *****
110 REM
120 PRINT "HZ"
130 INPUT "Frequency in Hertz" : F
140 IF F < 0 THEN GOTO 100
150 F=INT(F/1000)*1000
160 PRINT F/1000
170 REM
180 LET HZ=65536/F
190 BACKSPACE 1 : PRINT
200 PRINT "F = " : F
210 PRINT "Hz"
220 END
```

HERTZ II BY THERMIST

... it should have been 65536. That, I'm told, is a much more accurate figure. In any case, HERTZ needed a lot of tweaking up, so here is the program again, HERTZ II.

So, that's how you get the Hz and F's, but where do you get the note frequencies in Hertz from a G's base? (Note: The number after each pitch denotes the octave) See Table 1.

The 64 chip has a frequency range of between 0 and 400KHz. (That's pretty

Program Listing 3

```
100 REM ***** HZ BY THERMIST *****
110 REM
120 PRINT "HZ"
130 INPUT "Frequency in Hertz" : F
140 IF F < 0 THEN GOTO 100
150 F=INT(F/1000)*1000
160 PRINT F/1000
170 REM
180 LET HZ=65536/F
190 BACKSPACE 1 : PRINT
200 PRINT "F = " : F
210 PRINT "Hz"
220 END
```



Pitch	Hertz(Hz)	Pitch	Hertz(Hz)
C2	65.406	F 4	880.00
C 3	130.81	G 4	980.00
D 3	164.81	A 4	1100.00
D 3	164.81	A 4	1100.00
E 3	195.41	B 4	1234.56
F 3	195.41	C 5	1312.34
F 3	195.41	C 5	1312.34
G 3	209.01	D 5	1468.80
G 3	209.01	D 5	1468.80
A 3	220.00	E 5	1648.00
A 3	220.00	E 5	1648.00
B 3	246.94	F 5	1760.00
B 3	246.94	F 5	1760.00
C 4	261.63	G 5	1975.52
C 4	261.63	G 5	1975.52
D 4	293.68	A 5	2183.31
D 4	293.68	A 5	2183.31
E 4	329.63	B 5	2392.32
E 4	329.63	B 5	2392.32

Table 1



good for a synth the size of your fingertip, making it capable of deep rumblings and very-high twizzling higher even than a guitar can reach. Experiment with different pitches, even intermediate ones to itself for grooves, to produce ideas and melodies more like Latin music.

Special effects

A very important facility in the performance of a synth sound is that of gate (sometimes called portamento, good-as-I-know-why!). This means when you play note the next note gates smoothly up to correct pitch (rather than steps up to it). Let me demonstrate. The program renders a gliding note from C in the 4th octave to C in the 5th octave.

Address	128	64	32	16	8	4	2	1
94256								
94261	noise	pulse	tan	tri	scr	ring	mod	sync
94262								

Table 2

It is done by incrementing the pitch by very small amounts, so the steps aren't audible. To hear the steps, just put in a delay.

Timbre 2-1 (C) 100-94262

and now you can hear the stepping quite clearly. Cuda is used to great effect in computer music, adding a touch of humanity (beneficial) to otherwise digital outputs.

How some difficult bits

Take a deep breath the heart of each oscillator on the 5-D has a few very sophisticated controls. See Table 2. Synthesizers, or some, effects can give you some wonderful synth tones. One oscillator's waveform is modulated with another, the fundamental frequencies of the first being made to wobble in the second's. This gives you some very rich harmonic sounds, and although the pitch stays the same the harmonic content alters, giving you an enormous range of tone 'colours'. Syn for Osc 1 resides in address 94256 and to access it you POKE 94256.

Ring modulation, or ring mod, is perhaps best known for being the effect on a Dalek's voice. Fortunately it's also a synthesis and music tool to be a little less disturbing! Ring mod is primarily used as the creation of aquatic bell or gong tones, a ring mod/beat takes two frequencies and outputs a compound of the sum of the two frequencies (Huh!), and the difference between them. The result is a waveform whose harmonics are not related (they are normally), producing highly detailed metal or steel

qualities. A sample input/output might be like this:

Frequency 1 = 932.54Hz
Frequency 2 = 164.89Hz

Yocto = 944.81 + 932.52 = 1877.33Hz
and = 932.52 - 164.81 = 767.72Hz

In order to use ring mod on Osc 2 we must select both triangle and ring mod, ring mod modulates the rising phase of Osc 2 with the output of Osc 1. Really the best way for you to learn all about ring mod is to mess about with it, so try POKE 94256 16, (16=3 ring).

Give it a whirl and see what you can come up with.

Lastly, ring modulated waveforms contain all manner of unwanted harmonics which degrade the sound

quality. To clean them up you need to filter the sound.

Filter tips

With inspiration in my heart, it is my solemn duty to lead you by the nose into yet another topic, this time the region

	128	64	32	16	8	4	2	1
94261	-	-	-	-	-	-	-	-
94264	FC10	FC9	FC8	FC7	FC6	FC5	FC4	FC3
94265	815A	81	523.3					
94266	815A	815A	815A	815A	815A	815A	815A	815A
94267	815A	815A	815A	815A	815A	815A	815A	815A

Table 3

governing the filter. See Table 3.

The registers hold as follows:

Filter cut-off: 94265 and 94266

Register 94265's last five bits (5 to 0) left, the default here) used the remainder plus 94266 as the filter cut-off values, and as with previous registers, you can use them alone or added together to get $FC10 = FC9 + 128 = 128 + 128 = 256$. These bits don't control the cut-off point or the frequency of the filter; they are a reference point and the effect they cause is due entirely to the type of filter selected. See Filter Type/Volume.

Resonance/Filter: 94265

Resonance affects the frequencies around the cut-off point, emphasising them and making them brighter. The five these bits (bits 5 to 0) of the register govern which Oscillator goes through the filter. The fourth bit is very interesting. This is the external input to the filter,

whereby you can use the filter in the 4th synth to filter an external instrument's output (interesting though it is, it really wouldn't be used without expert advice - you can follow up the chip if you're not careful).

Filter type/volume: 94266

The first four bits govern the overall volume of the system in a scale of sixteen values, from 0 (not a surprise) to 15 (plating your speaker with). The next three bits select filter type: hi-pass, lo-pass and band pass. Hi-pass lets high frequencies through, lo-pass lets low frequencies through and band pass lets frequencies at and either side of the cut-off point through and stops those further away. There is actually another type of filter available if you add hi and band pass together - band reject or notch. The next three bits of band pass, letting through all frequencies save the ones at the selected cut-off. The last bit in the register is Osc 3 ON. Oscillator 3 can be very useful as a modulator for the other two, and in this case the output from it might be undesirable (very loud), so this gives us the option to toggle it out of use.

The sophistication of the 5-D's filter is the one thing which sets it far above, and should be above other means, synthesizers. It gives you power over an enormous range of beautiful sonic

textures and tone colours, which brings me to our last section, with some fun on Immersive Synthesis.

Is it real, or is it... synthesised?

Immersive synthesis is the art (or in some cases science) of creating natural sounds or conventional instruments. This is a controversial topic, as synths can imitate any instrument, with intelligent programming, and you try telling that to the Musicians' Union: they'd smash your face in! Synthesizers, and Computer keyboards generally, are seen to be doing what the advent of working musicians what the advent of computers did to the number of working accountants. Personally, I don't think musicians have anything to worry about! Making sounds as good as a real instrument played well on a real person.

And, next month, I'll include some facts and tips on how to create all your favourite instruments.

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the whole, or part of
the screen, on or off.

THE MOST COMMON USE OF flashing is that of prompting the operator to take some action by flashing a message several times on the screen.

In the little program called BASIC-FLASH, notice that A\$ is initialised to a message in line 30 and a delay constant defined in line 40.

The main FLASH sub-routine (lines 600-650) prints the message, activates a delay loop, calculates the message and activates a similar delay loop. If no key is pressed, the whole sub-routine is re-entered until any key press generates a RETURN. The crucial line is probably line 1830 which is merely a cursor up (CHR\$(9)) followed by a blank line and terminated by another cursor up. This technique, as variations built around it, will work on any Commodore machine.

Commodore 64 owners might like to try the following 'one liner' which provides a quick and handy 'screen-clear'.

```
FOR PO TO 39: POKE 10700: NEXT
```

The following technique is usually used to flash the screen. First of all, get the character from the screen and then TAB(SCREEN) to a row 80(SCREEN) - this 'flashes' it from a 1 to 0 and/or vice versa thus giving 'negative' or 'inverted' graphics. Then put the new character back into the same position. In earlier versions of the Commodore 64 the colour must also be POKE'd back to the screen.

Either the whole screen, or just particular sections of it, can be reversed. With 1008-1009,2,

RELIABLE ROUTINES

to the screen and the colour memory map, this would take an eternity in BASIC.

The machine code routine, REVERSE-FLASHER, overcomes the long wait. If the subroutine is called once only, then a certain portion of the screen is reversed; if a delay loop is built in and the process repeated several times, you can get the flashing effect you desire.

Your first task in REVERSE-FLASHER is to decide where to locate the code - I have placed it in the cassette buffer out of force of habit but it can go into any location. MCODE(10) is a good place if not occupied by anything else and if you make variable IN LOCATIONS in line 10 the starting point of your code.

Next, three parameters are

provided: the file character colour, PAPER (the background colour) and the number of lines (starting from the top of the screen). The demo is set up so that INK is black, PAPER is grey 1 and the number of lines is set to 10. To flash the whole screen the number of lines would be 20.

The routine saves the current character colour and background colour and then restores them after the flash. The 'new' flashing effect is obtained if the initial paper colour is maintained throughout: this is because, if you change the PAPER colour, the

whole screen is changed to that colour while the first 10 lines will flash. The delay loop may be shortened or lengthened or even cut out altogether. The length of the whole flash can also be controlled in a similar fashion by altering the initial value of the J loop in line 80.

It is hard to experiment with this routine until you find an effect which suits you best.

Finally, a machine-code disclaimer is provided, for those readers who like to study such things to see how they work and also improve them if necessary.

Happy Flashing!

Program Listing

```

1 REM *** REVERSE . FLASHER ***
2
3 REM BY MIKE HART
4
5 REM SYNOPSIS: REVERSE INK, PAPER, LINES
6
7
8 LINES=INK+PAPER+LINES+10
9
10 FOR J=0 TO 87: READ H
11
12 T=POKE LNK, H: NEXT
13
14 READ CH: IF CH#T THEN 60
15
16 PRINT"DATA BRIGHT"END
17
18
19 REM *** DEMO ONLY ***
20
21
22 FOR J=1 TO 50:SYSOUT(INK,PAPER,LINES
23
24 FOR CL=1 TO 8:PRINT CL:PRINT J
25
26 DATA 170,30,200,100,250,170,134,8
27 DATA 120,204,30,200,100,140,30,200
28 DATA 30,241,100,130,70,100,20,100
29 DATA 0,157,0,210,100,0,217,100
30 DATA 0,200,100,0,200,200,200,200
31 DATA 100,170,100,0,100,201,100,0
32 DATA 100,220,100,30,177,201,170,100
33 DATA 140,201,100,10,247,200,240,10
34 DATA 04,100,40,101,201,100,201,100
35 DATA 200,200,250,170,200,100,200,141
36 DATA 30,200,100,204,141,134,0,200
37 DATA 10779
38
39

```

Memory									
80	90	100	110	120	130	140	150	160	170
0000	00	01	00	100	0000	1			
0001	00	00	00	070	0000				
0002	00	00	00	100	0000				
0003	00	00	00	100	0000				
0004	00	00	00	070	0000				
0005	00	00	00	070	0000				
0006	00	00	00	070	0000				
0007	00	00	00	070	0000				
0008	00	00	00	070	0000				
0009	00	00	00	070	0000				
000A	00	00	00	070	0000				
000B	00	00	00	070	0000				
000C	00	00	00	070	0000				
000D	00	00	00	070	0000				
000E	00	00	00	070	0000				
000F	00	00	00	070	0000				
0010	00	00	00	070	0000				
0011	00	00	00	070	0000				
0012	00	00	00	070	0000				
0013	00	00	00	070	0000				
0014	00	00	00	070	0000				
0015	00	00	00	070	0000				
0016	00	00	00	070	0000				
0017	00	00	00	070	0000				
0018	00	00	00	070	0000				
0019	00	00	00	070	0000				
001A	00	00	00	070	0000				
001B	00	00	00	070	0000				
001C	00	00	00	070	0000				
001D	00	00	00	070	0000				
001E	00	00	00	070	0000				
001F	00	00	00	070	0000				
0020	00	00	00	070	0000				
0021	00	00	00	070	0000				
0022	00	00	00	070	0000				
0023	00	00	00	070	0000				
0024	00	00	00	070	0000				
0025	00	00	00	070	0000				
0026	00	00	00	070	0000				
0027	00	00	00	070	0000				
0028	00	00	00	070	0000				
0029	00	00	00	070	0000				
002A	00	00	00	070	0000				
002B	00	00	00	070	0000				
002C	00	00	00	070	0000				
002D	00	00	00	070	0000				
002E	00	00	00	070	0000				
002F	00	00	00	070	0000				

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Written by
Vaughan Dore
Jump Jet Pilot

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ANIROG

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